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THE INFLUENCE OF LEARNING STRATEGY AND PERFORMANCE STRATEGY UPO--ETC(U)
NOV 76 R BAILEY, D ENSOR, G PASK, T WATTS F44620-76-C-0003
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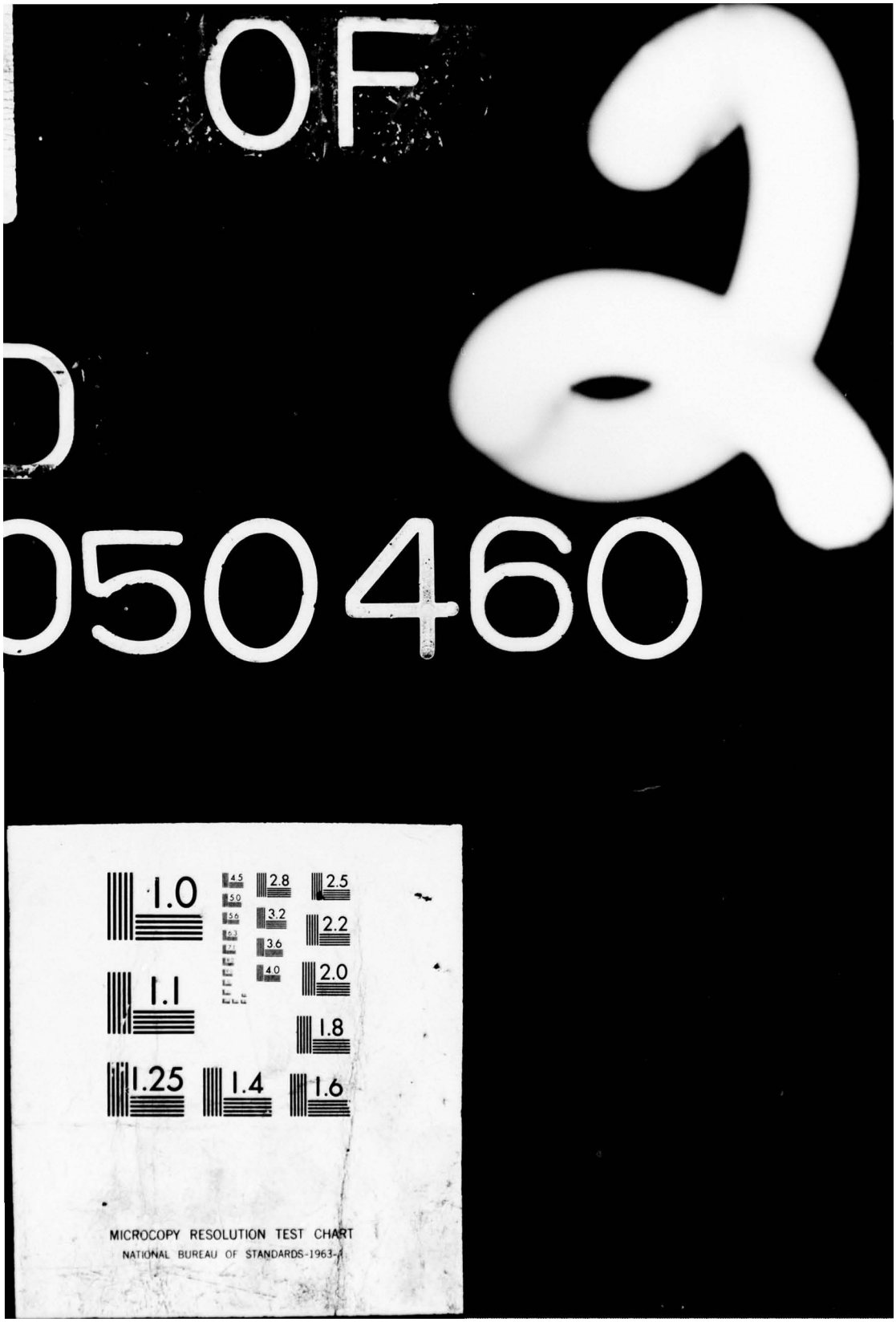
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REPORT DOCUMENTATION PAGE

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1. REPORT NUMBER: AFOSR-TR-78-0134
2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle): The Influence of learning strategy and Performance strategy upon Engineering Design.
5. TYPE OF REPORT & PERIOD COVERED: Interim Scientific, 1 May 76 - 30 Sep 76
6. PERFORMING ORG. REPORT NUMBER: Progress Report 4
7. AUTHOR(s): Bailey, R., Ensor, D., Pask, G. R/Bailey, D/Ensor G/Pask
8. CONTRACT OR GRANT NUMBER(s): F44620-76-C-0003
9. PERFORMING ORGANIZATION NAME AND ADDRESS: System Research Ltd - Woodville House, 37 Sheen Road, Richmond, Surrey, England
10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: 61102F, 2313A2
11. CONTROLLING OFFICE NAME AND ADDRESS: Air Force Office of Scientific Research (NL), Bolling AFB, DC 20332
12. REPORT DATE: November 1976
13. NUMBER OF PAGES: 96 + 100 p.
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): Progress rept. no. 4, 1 May - 30 Sep 76,
15. SECURITY CLASS. (of this report): Unclassified
15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

COPY AVAILABLE TO DDC DOES NOT PERMIT FULLY LEGIBLE PRODUCTION

DDC RECEIVED FEB 23 1978 F

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Computer administered tests for cognitive style, Creativity in Design, Objective analysis of design process, Educational simulator chemical reaction kinetics.

(AD-A050 460), (raised in)

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This ~~progress~~ report answers questions ~~asked in connection with~~ Progress Report 3, and clarifies the hypotheses being tested and the measures being employed as determinants of cognitive style and design products (reaction simulator, in the first design task).

The report contains a brief account of two designs produced by two expert designers, ~~(appendices 1 to 5 contain mathematical details).~~ Design time (Since)

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Abstract (continued)

proved longer than expected, (about 50 hours for the first design task). Steps have been taken to reduce design time for the first task to 25 to 30 hours by modifying the design brief issued to subjects, predetermining circuit configurations that occupy a disproportionate amount of effort as modules and predefining some of the test procedures. As a result, it should be possible to conduct the entire experiment (including tests and team design task) within 50 or 60 hours without losing the essential features of the first task; in particular, the designer may innovate by analogical reasoning within the (electronic) task domain or between the task domain and the (physical chemistry) application domain. An initial breakdown of the first design task is provided.

Later sections of the report give a detailed description of the computer-administered stylistic tests (a program listing is attached as Appendix 6) and discusses the ongoing recruitment of expert and inexperienced subjects.

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Progress Report 4

Contract No : F44620-76-C-0003

1st May 1976 to 30 September 1976

Principal Investigator: G Pask
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Dated November 1976

Contractor's signature ...G Pask.....

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Progress Report 4

Contract Number : F44620-76-C-0003

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Progress Report No 4: October 31st 1976

1. Introduction

In this section (1) we outline the organisation of the present report, review the background (Section 1.1) and comment upon changes in the work statement (Section 1.2) instituted and agreed since progress report 3.

In response to a letter from Dr Fregly, (3rd September, but received, due to sea mail delivery, in October) certain specific points about the content of Progress Report No 3 are dealt with, by way of clarification, in Section 2 of this report).

Section 3 is a description of experience in pilot experiments with expert designers and contains comments upon some difficulties encountered and remedied. Section 4 is an account of revisions in the design brief of Progress Report 3 needed to reduce the period spent in marginally relevant activity and to render the first design task acceptable to student designers. Section 5 lists the modules at the disposal of subjects and Section 6 provides a breakdown of the first design task into subtasks.

Sections 7 and 8 are differently oriented.

Section 7 details the computer administered stylistic tests by showing one sample pass through the program and thus furnishes a realistic picture of how subjects respond.

Finally, Section 8 describes the recruitment of subjects for the experts (Group A) and the student designers (Group B).

The listing of the stylistic test program, as well as all mathematical and technical matters, are relegated to Appendices in order to render the report more easily readable.

1.1. Background

Work completed up to the end of June was described in Progress Report No 3 (delayed by 1 month, in order to consolidate the design task specification). Up to that point, we had prepared background material, interviewed members of the target population of subjects namely, experienced designers (Group A) and student designers (Group B). The interface equipment was completed and programs had been written for stylistic pre and post testing of subjects. An overall plan of the experiment was specified (Table 3, Progress Report No 3) and a design task had been determined. The main variation upon previously reported work was the division of the design task, undertaken by subjects in Group A as well as Group B, into parts; the "first design task" (which is individually performed and monitored) and the "second design task" (undertaken by teams of subjects). One advantage of the division is that the second desing task allows us to observe and record communication between designers, starting off from the individual designs produced in the first task.

1.2. Review of Changes in Work Statement

Due to change P00001 of 1st August 1976, a further clause (a) is introduced into the contract "the design task in which innovative behaviour is to be investigated will be broken down into discriminating stages". A breakdown (based, at this stage, upon experience with 2 expert designers who completed the first design task) is described in the present report. Due to a change (insertion of clauses f and g) embodied in P00002 of 1st August 1976, forthcoming work includes (f) "assess the design task set forth in paragraph (e)" and (g) "to examine posited improvement in versatility as a function of specific assistance", (versatility training).

2. Replies to Questions about Progress Report 3

Some specific enquiries regarding points of clarification were noted in a letter from Dr Fregly. The questions refer to Table 3 of progress report 3 and the general experimental design. Fortunately, it was possible to meet Dr Fregly and Dr Hutchinson in Washington, as the present report was nearing completion and to discuss each question, informally. This section of the present report thus recapitulates our discussion and spells out the replies in greater detail. The questions are as follows :

(1) Question: What hypotheses are being tested in the study: what relationships are expected between cognitive style and design product.

Reply: (a) As a main hypothesis, designers (either experts, Group A, or students, Group B) who exhibit high versatility scores on the stylistic tests will produce better rated designs, satisfying the boundary conditions (of "optimising", reliability, transparency weight/size/cost, and environmental sensitivity) than those having relatively low versatility scores. In other words, it is believed that "versatility" (see (3) below) is a reliable index of potential design creativity. We do not, however, exclude the possibility that other indices (see (3) below) may be predictive; nor is the evaluation of the design product restricted only to the four "optimising" criteria stated explicitly.

(b) That the process of design, as monitored by the "analytic session" data (Progress Report 3, Section 2.3) will reveal a greater use of valid analogical reasoning on the part of designers deemed "good" on any of these criteria, especially in the use of analogies between the pure (electonic) design task domain and the (physical chemistry) application domain.

(c) As a subsidiary hypothesis, subjects who have a high comprehension learning score (see (3) below) but relatively low versatility, will also use analogical reasoning but will be prone to rely upon superficial analogies which may be misleading.

(d) As a further subsidiary hypothesis, suggested by recent studies of machine aided architectural design, there will be little difference in the form or quality of the designs offered by Group A and Group B (experts and students) who have similar versatility scores. There are several studies which indicate that if people interact with appropriately chosen computer aids (chiefly, but not exclusively, in architectural design) the products of professionals and of users who are not versed in the design skill (architecture) differ very little. The particular study which highlighted this subsidiary hypothesis was carried out at the University of Strathclyde, by Maver and his associates, where the professionals (experts) designed infant school layouts and the users (students) were principals of such infant schools.

(2) Question: What types of subjects will be used.

Reply: (a) Expert designers with experience in industry obtained from a hardware consulting firm (Ilex Electronics Ltd) from Cambridge Electronics Ltd and other industrial sources; faculty members with previous experience either in industry or in large scale development (for example, equipment which is replicated by subcontractors, though used in a research environment).

(b) Student designers will include postgraduates from Chelsea College in the University of London, doing a (night school) masters option in Cybernetics, with a background of electronic engineering, post graduate students in the Department of Cybernetics, and the Department of Engineering at Brunel University; students from Kingston Polytechnic, North East London Polytechnic and other Polytechnic institutes. All of these subjects have an initial knowledge of general science and of electronic principles but none of them have engaged in serious design work.

(3) Question: What variables are measured in the Pretest and what is the quantitative form of each variable.

Reply: (a) In the revised (and computer administration compatible) scoring scheme 68 "point" scores are recorded together with 18 confidence estimates (in the computer version, calibrated against objective performance in the learning phase) which refer to entire recall questions.

The point scores are aggregated as follows.

Versatility is scored on ability to make a prediction which, if accurate, depends upon integrating knowledge of local rules and global rules, plus a product based score indicating recall of all rules (the behaviours and networks excluding the predicted ones), since successful overall recall also depends upon integrating knowledge of local and global rules. Comprehension learning is estimated by summing point scores for all graph or network recall scores, together with scores on questions that call for an appreciation of global relations. Operation learning is estimated by summing scores indicating knowledge of local rules governing behaviours at various phases (epochs, years) together with scores for specific questions indicating knowledge of local rules. A neutral score of gross recall is obtained by counting correctly recalled items regardless of their order or relation.

When normalised with respect to the neutral score, the main variables are (50 valued) scale estimates of Versatility, of Comprehension learning and of Operation learning, all based upon objectively correct response scores.

Subsidiary discrimination is possible, in respect of whether the global/local (alias, comprehension/operation) difference is due to recall of abstract (graph) relations or interpreted (geographical network) relations. A further subsidiary discrimination is possible between subjects who merely wrote recall lists and those genuine operation learners who (rightly) interpret the lists as describing local rules. By other than objective scoring of the recorded data, it is possible to estimate a distinct global/local tendency and a tendency to invent descriptive predicates/use given descriptive predicates.

All of these indices may be refined if the point scores are augmented by the confidence estimation data. The refined quantification will be calculated but we cannot, as yet, rely upon the figures (though it may be possible to do so before the results are analysed) since confidence estimation was introduced with the computer administered form of the test and insufficient data is available, at the moment.

(b) Subjects are pretested using the Raven Progressive Matrices II, the Witgin Embedded Figures Test (advanced form) and the Lancaster Inventory for deep and surface level processing. *

(4) Question: What variables are measured on the products of the first design task, what quantitative score for each variable and what methods are used for obtaining these scores.

Reply: (a) Stage by stage measurement is achieved by means of the analytic session after each design session in the first design task. The data consists in an entailment mesh representing (in the THOUGHTSTICKER system) the designers "thesis" or "theory" about his work up to this point.

(b) In addition, the workability of the design at each stage is estimated, by trying out its parts.

(c) A series of such (objective) records, one for each design session, can be analysed in several ways. The most general quantitative procedure is a "q-analysis" and "pseudo-homotopy analysis" (Atkin 1964, 1965, 1966) ≠ of the entailment meshes.

(d) Specific features can be extracted from the analytic session records and we immediately contemplate an analysis to determine the incidence of valid analogical reasoning and non valid analogical reasoning (this is a mechanically executed, quantitative process).

(e) Other specific features include back tracking in design ideation and the interval needed to remedy mistakes, if any, in the stage by stage design product.

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* Entwistle N.E. and Robinson M. (1976) Personality cognitive style and students learning strategies 2nd Congress European association for research and development in Higher Education, Louvain, Belgium.

≠ Atkin R. (1964) Mathematical Structure in Human Affairs Heinmann. (1965, 1966) Research Reports, Department of Mathematics, University of Essex.

(f) The final first design products are to be evaluated in terms of function and the four optimising criteria, using expert designers as judges (Progress Report 3 Section 2.8).

(g) Although dialogue between designers and the experimenter is tape recorded we regard content analysis of this dialogue as optional and will determine whether or not the analysis is likely to be worthwhile only when tape recordings have been obtained.

(5) Question : What variables are to be measured on the second design task, what is the quantitative score for each variable and by what method is the score obtained.

Reply: The same types of measurement and evaluation as noted in replies (4) (a) to (4) (f) with certain differences due to the fact that the second design task and is a group task primarily intended to sample communication between designers acting as a team.

One difference is that only two analytic sessions are available for each individual in a group (one of the two at an arbitrary point in the team task, and the other at the completion of the team task), hence, the progressive measurements (of (4) (a), (b), (c), (d)) are less detailed.

The other difference is that tape recorded dialogue reflecting communication between designers, is taken seriously and the dialogue will be content analysed (in contrast to the doubtful status of dialogue noted in (4) (g)). The analytic method is not yet decided, but it appears that Holsti's propositional analysis * is preferable to more usual methods based, for example, upon Osgood's semantic differential.

(6) Question: What variables will be measured on each subject during the post test. What is the quantitative form of the variables.

Reply: The variables in the stylistic test (a matched form of the pretest for style) are those considered already in reply 3(a). It is also intended to administer the Lancaster Inventory for deep

* Holsti O.R. (1969) Content Analysis for the Social Sciences and Humanties, Addison Wesley.

and superficial learning, further progressive matrices and further Embedded Figures tests (as in reply 3(b)). Other tests were suggested by Dr Fregly, at our recent meeting in Washington; notably, a test for sensitivity/insensitivity and for externalisation/ internalisation developed by Dr Reason of Leicester University (since subjects are already taking part in the experiments, these tests cannot be incorporated as pretests, but are candidate post tests).

(7) Question: What analysis is planned. What relationships between the subject data and the design product data are to be examined.

Reply: (a) Absolute stylistic profiles for experts (Group A) and students (Group B).

(b) Pretest/post test stylistic comparison. We expect a general increase in versatility as a result of a design experience in which the analytic sessions present the designer with information, that is not generally available, concerning the mental operations that accompany his design and force him to exteriorise part, at any rate, of his cognition. We predict that the change will be less for experts than students, due to cognitive fixity and that a greater increase in versatility will be evident amongst those subjects selected for and given specific versatility training.

(c) Absolute (objective, analytic session) measures for individuals in the first design task (see (4) (a), (b), (c)).

(d) Absolute (objective, analytic session) measures for individuals in the second (team) design task (See (5)).

(e) Individual comparison (hypothesis of positive transfer of learning) for individuals between first and second design task.

(f) Comparison between first design product evaluation and versatility (positive correlation is hypothesised).

(g) Comparison of design method (notably, in use of valid analogical reasoning) and the evaluated quality of design product (first design task).

(h) Quality of team design and form of interpersonal dialogue.

(i) Versatility compared (hypothesised positive correlation) with intermediate level of field independence (Witgin, Embedded figures).

(k) No significant difference in method between experts (Group A) and students (Group B) in first design task.

(8) The replies to question 7 represent only a sample of many possible measurements and comparisons that are possible because of detailed analytic session and test response recording over a realistically complex pair of design tasks. Until data are collected in fair quantity (surely not at this stage) we hesitate to predict the relative value of the comparisons, apart from the statement of some key hypotheses (reply to Question 1). In turn, it would be premature to lay down guidelines for the most useful statistical tests: it is evident that the records are well quantified so that various statistical techniques are applicable within the experimental framework of Progress Report 3, Table 3. Of these, some are well known (Students t Test for significant differences; analysis of variance, etc) but others, which seek out significant differences reflecting different design methods, though less well known, may be of equal or greater merit.

3. Experience with first pilot studies.

The first design task has been completed by two expert designers who produced quite different design solutions and parts of the task have been tried out using inexperienced (student) designers.

3.1. Summary of Experience.

One expert's solution is shown in Fig 1 and it closely resembles the original form presented in Progress Report 3; the other expert's solution is shown in Fig 2. These solutions are based upon different mathematical formulations as indicated in Appendix 1 (for Fig 1) and Appendix 2 (for Fig 2). The (expert) subjects took 47 and 55 man hours to complete and check their designs.

Fig 3 is a photograph of one completed design.

In both cases, the subjects did detect similarities between circuit functions (valid analogies within the task domain) and, in both cases, the subjects used information about physical chemistry to form valid analogies between the task domain and the application domain. The latter finding is particularly gratifying because it indicates that the task is taken seriously and not abstracted as a problem solving puzzle.

The number of hours required (47 and 55) is greater than anticipated. This result is pleasing insofar as it vouches for the realism of the task but slightly alarming if we suppose that student designers will take even longer to complete the assignment. Consequently, we examined the design process to detect stages which were exceptionally time consuming and which might be deemed irrelevant to the main theme. These stages cannot be eliminated, but the time occupied can be reduced by specifying what must be done (ie. giving a standard method) instead of allowing for deliberation.

3.2. Difficulties Encountered.

On inspecting the combined evidence, there appear to be two types of "hang up" which certainly form part of design but are quite legitimately seen as peripheral to the first design task. One of them concerns the detailed design of circuit elements which are essential in any reaction simulator. For example, the experts spent many hours trying to perfect a logarithmic amplifier (for computing logarithms and, inversely, antilogarithms of quantities) constructed using operational amplifiers and matched transistors. This subtask is interesting in its own right, but occupies a disproportionately large amount of time. The other "hang up" concerns choice of the performance criterion to be used as indicating that the design specification is satisfied.

These two types of difficulty have been tackled (a) by modifying the designers "brief" or "specification" and the basic modules or components at his disposal (so that, for example, a Logarithmic Amplifier is supplied as a prefabricated element). (b) By stipulating, more precisely, what tests are to be carried out, which is tantamount to providing the task "breakdown" into "subtasks" noted in Section 1.2.

Many of the tests involve curve plotting; the designed simulator should behave in accordance with digitally computed values. In practice, we give subjects access to a computer terminal with the easy to use interactive language BASIC (in addition to the calculator noted in Progress Report 3) so that it is a simple matter to compute values of a given function and compare these with the readings obtained from the (designed) reaction simulator.

Changes in the "brief" or "specification" are described in Section 4 (as a tightening up of the brief given in Progress Report 3, Section 2.7), the modules are described in Section 5 and the task breakdown, in Section 6.

4. Modifications to the design brief for first design task.

The original brief (Progress Report 3, Section 2.7), stands, in outline, but has been modified by incorporating the following clauses and restrictions.

(1) The display format (using meters, but with connections allowing for repetitive operation and an oscilloscope display) is mandatory rather than optional (as it was in the original brief).

(2) Reaction simulator units must be impedance-wise, and voltage-wise compatible for interconnection, as series or parallel arrangements, in order to simulate a complex reaction in terms of simple reactions.

(3) The "thermostat" and the circuitry concerned with varying reaction rates as a function of the computed "temperature" is to be an integral unit, compatible for interconnection to not less than 5 reaction simulator units.

(4) In view of (2) and (3) above, the designer should restrict attention to integral values in the exponents of the concentration terms of the rate equation; in other words, any one reaction simulator may represent a simple reaction (of 1st order, or 2nd order, etc), these integral orders to be variable, in steps, for each reaction path).

(5) Integration, Exponentiation, Summation, etc, must be performed by analogue components (a mandate, not an option, as in the original brief).

(6) The equation for "net rate" (λ net) is made explicit (see Appendix 3) and so is the equation for Δ H (see Appendix 3). In the original brief these relations were to be derived.

(7) A test board is provided with potentiometers, switches and monitoring sockets for all relevant quantities namely:-

Stoichiometric coefficients - rotary switches N_A, N_B, N_C, N_D
For reaction $N_A A + N_B B \rightleftharpoons N_C C + N_D D$

Arrhennius Function Parameters - Potentiometers
Log A_F - Frequency factor for forward reaction

E^*_F - Activation energy for forward reaction

Log A_R - Frequency factor for reverse reaction

E^*_R - Activation energy for reverse reaction

Rate constant - Manually set/computed from Arrhenius expression - switches.

Monitoring Sockets - Forward rate constant (K_F) reverse rate constant (K_R) , temperature, concentration of A, B, C, D.

The following parts of the brief have been modified in accordance with the conditions listed above as (1) to (7) and mostly refer to test procedures that are, in the revised brief, spelled out as specific requirements. The degree of freedom for making fundamental mistakes is thus reduced and consequently the potentially available information about misbegotten design methods. On balance, however, we feel that the loss of (potential) information is more than offset by the likelihood of smoother and more expeditious conduct in an experimental task which is still unusually rich and realistic.

Some test procedures involve curve plotting and the comparison of the (designed) simulator's behaviour with the behaviour of a computer program written in BASIC (Section 3.2) . Examples are given in the discussion (Section 6) of the task breakdown.

(a) Given input parameters set to produce an nth order reaction a graph of concentration of a reactant or product vs. time should give the appropriate reaction profile. (ie. unmistakably nth order.).

(b) For any given setting of input parameters the value(s) obtained for the rate constant (from graphs) should be predictable and repeatable.

(c) The rate constant should approximately double for every 10° Kelvin rise in temperature and plots of Log. (rate constant) vs $(Temp)^{-1}$ should be linear.

(d) If the Activation Energy parameter, for either forward (E_F^*) or reverse reactions (E_R^*), is increased then the rate constant (K_F or K_R) should decrease.

(e) If the frequency factor A_F (for the forward reaction); A_R (for the reverse reaction); is increased then K_F or K_R should increase.

(f) If $E_F^* > E_R^*$ then the enthalpy change for the reaction ($\Delta H = E_F^* - E_R^*$) is negative and the reaction is exothermic.

If $E_F^* < E_R^*$ then the enthalpy change is positive and the reaction is endothermic.

(g) Observed values of the equilibrium constant for a reaction should agree with expected values (according to the "equilibrium law") to within typical margins of experimental error (10%)

(h) The equilibrium constant for a reaction should increase with temperature rise if the reaction is endothermic and decrease with temperature rise if the reaction is exothermic . Graphs of Log (equilibirum constant) vs. $(Temp)^{-1}$ should be linear.

5. Modules made available to the designer.

As noted in Section 3, some relatively irrelevant problems of circuit configuration delayed the expert designers and it seems likely that these problems would cause even greater trouble to an inexperienced student designer. In order to reduce the number of man hours spent in designing, we have thus replaced some of the electronic components, noted in Progress Report 3, by modules that are prefabricated.

Apart from the experimental convenience obtained by doing so, this expedient is in accord with the philosophy of "modular design" which is nowadays commonly accepted and agreed to be effective.

The modules are as follows :

(1) Integrating amplifiers (2 types)
(2) Logarithmic amplifiers (2 types)
(3) Summing amplifiers (2 types)
(4) Multipliers
(5) Dividers
(6) Exponentiators (4, 5, and 6 are all configurations of components around one operational multiplier I.C.)
(7) Mode control circuits (2 types) used to run, reset, or cycle an integrator.
(8) CMOS analog switches (4 channel ICs)
(9) Antilog amplifiers
(10) Resistors, capacitances, boards, wire, light emiting diodes, lamps, etc.
(11) Display meters, oscilloscope and indicators (from Section 4 the display format is mandatory) and the test board of Section 4 providing standard inputs.

6. Breakdown of the first design task.

It is possible to conceive two basically different approaches to the design of a reaction simulator, even though an analogue design is mandatory under the revised brief.

(a) Having determined the overall requirements, the designer might manipulate the functions to be computed in order to minimise the number of circuit elements required.

(b) Having determined the overall requirements, the designer might organise the circuit elements so that there is a one to one correspondence between blocks of components and variables entering into the computation of functions that reflect (are analogous to) a concrete process.

The first of these alternatives ((a) above) could lead to an elegant but inflexible and far from transparent design. In any case, a pure form of (a) is precluded as a result of constraints (for example, Section 4 clause (3)) built into the revised brief and our task breakdown is based, primarily, upon (b). This decision is not so restrictive as it seems to be at first sight, since the subject is allowed to design, within the brief, in any order he likes (for example, he could do all the paperwork and calculation first, making up a circuit to realise his paperwork later; he could complete the paperwork needed to specify a module, build the module and return to further paperwork).

The breakdown thus specifies an unordered set of subtasks. Though all of the subtasks must be completed, it is possible (and, judging by the two experts' comments) usual to partially complete a subtask, reenter a different subtask, weaves through several related activities and returns to the original subtask (which may be completed at this stage or again put aside to deal with some other subtask).

The following breakdown excludes those features of the design (such as the display format and the existence of a thermostat unit as an integral entity) that are determined by the design brief.

1. Mathematical formulation of complete system.
2. Design in terms of functional blocks
3. Detailed specification of modules eg.- Integrators, rate expression generators, Arrhenius Function generators, Thermostat (temperature control) unit, Enthalpy/temperature change display driver
4. Selection of components (circuit design) for each module.
5. Physical layout for function modules
6. Computer simulation to test scaling factors, and compatibility of modules (Fig 4 and Appendix 4, for details)
7. Construction and testing of integrators
8. Construction and testing of rate expression generator
9. Construction and testing complete system without temperature functions (using computed solutions for comparison)
10. Construction and testing of temperature modules
11. Overall testing - check relationship between rate and temperature and equilibrium constant and temperature. (Fig 5 and Appendix for details).

7. Computer Administration of stylistic tests

The spy Ring History Test (Progress Report 3) and matched stylistic tests are most conveniently administered by a computer. It is thus possible to ensure that transaction lists are learned to criterion, to elicit confidence estimates from the subject and to calibrate them against objective correct response probabilities during the learning trials, thus giving a meaning to confidence estimates elicited with respect to recall of (the usually transformed and recorded) information.

During recall it is also possible to give the subject free but monitored access to data items which he may heed to complete a response; as a result to determine the pattern of "gaps in his knowledge" which (though we have not yet made serious use of the data) is believed to be symptomatic of learning style. In particular the subject is provided prior to each recall trial, with a "menu of data items" through which he may access data selectively and at a given cost in terms of points. He is asked to minimise the cost (ie the number of points) needed to recall the original material at a given (greater than 0.8) level of confidence. The number of points which may be expended in data access is currently set at 50 but the initial number of points (or, for that matter, selective costs) can be adaptively controlled as a function of indivdiaul performance during the learning trials. Even as it stands, the recall trial confidence estimates are interpreted according to the objective calibration established during the learning trials.

These features of the test administration program were noted in Progress Report 3. In the present report the program listing is given in Appendix 5 and salient stages in one pass through the test (one subject) are shown in the composite Fig 6. The subject has read, at leisure, the "background data", presented as a booklet (as used in the manually administered test) and has already learned and recalled the practice lists. Consequently, the subject is familiar with the possibility and providence of en coding the relation expressed by a list as a graph, he is further aware that this encoding does not capture the entire content of an activity (a message transmission behaviour) except in special

7. Computer Administration of stylistic tests

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During recall it is also possible to give the subject free but monitored access to data items which he may need to complete a response; as a result to determine the pattern of "gaps in his knowledge" which (though we have not yet made serious use of the data) is believed to be symptomatic of learning style. In particular the subject is provided prior to each recall trial, with a "menu of data items" through which he may access data selectively and at a given cost in terms of points. He is asked to minimise the cost (ie the number of points) needed to recall the original material at a given (greater than 0.8) level of confidence. The number of points which may be expended in data access is currently set at 50 but the initial number of points (or, for that matter, selective costs) can be adaptively controlled as a function of indivdiaul performance during the learning trials. Even as it stands, the recall trial confidence estimates are interpreted according to the objective calibration established during the learning trials.

These features of the test administration program were noted in Progress Report 3. In the present report the program listing is given in Appendix 5 and salient stages in one pass through the test (one subject) are shown in the composite Fig 6. The subject has read, at leisure, the "background data", presented as a booklet (as used in the manually administered test) and has already learned and recalled the practice lists. Consequently, the subject is familiar with the possibility and providence of en coding the relation expressed by a list as a graph, he is further aware that this encoding does not capture the entire content of an activity (a message transmission behaviour) except in special

cases . Finally, at this stage, he is alive, to the further possibility of describing either lists or graphs by descriptors like the predicate with values called "countries" in the test.

The frames in Fig 6 represent the images presented to the subject either on the ARDS display or a random access projector * contingent upon his adopting a particular response pattern which is spelled out by the captions. Some repetitions have been omitted but the sequence is complete enough to show each kind of event.

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* The random access projector is optional since the information in question could be presented through any graphics display. The device is used in this implementation as a matter of convenience only and the slides embody information which could be computed from data stored in the machine.

8. Subjects.

Subjects are recruited on the understanding that if they pass the "filtering" preliminaries (Table 3 of Progress Report 3) they may expect to engage in no more than 50 to 60 hours of work. Sessions for the first design task are arranged at their convenience; for the team task, by consensus. This figure is realistic, insofar as the revised first design brief should reduce the design time for an expert to (roughly) 25 hours and for a student (training included) to roughly 35 or 40 hours.

So far, 5 more expert (Group A) subjects have agreed to participate and 6 students (Group B). The tasks do appear to arouse interest and it takes some while for information about the experiment to "get around" the polytechnic population. Enquiries are expected to come in for consideration throughout the next month and no great difficulty is anticipated in obtaining an adequate number (at the moment the absolute number is undetermined) of suitable student designer subjects and to do so relying, chiefly, on word of mouth publicity. No attempt has yet been made to obtain Chelsea College students, since the postgraduate evening class commences in January.

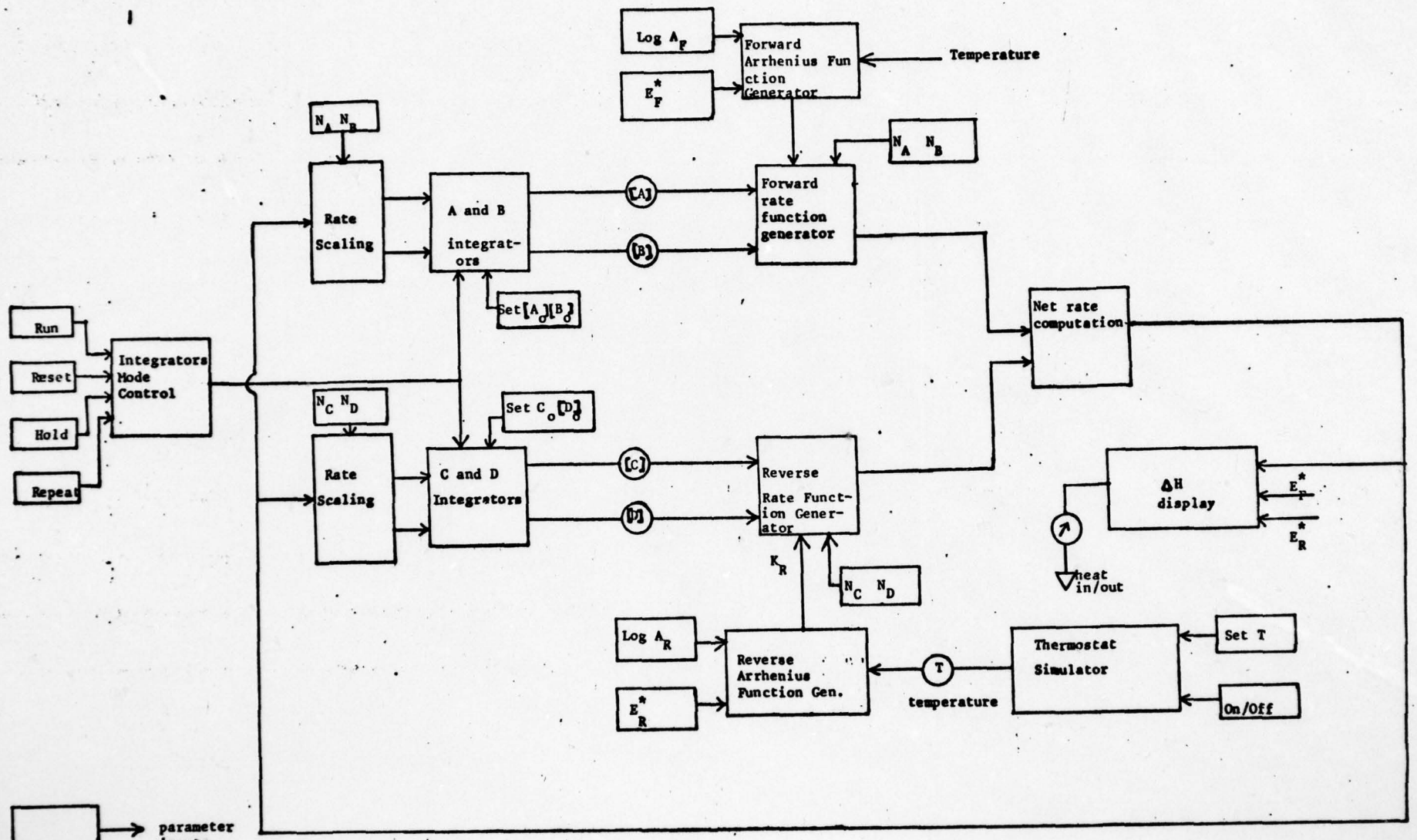


Fig 1. Simulator Design 1

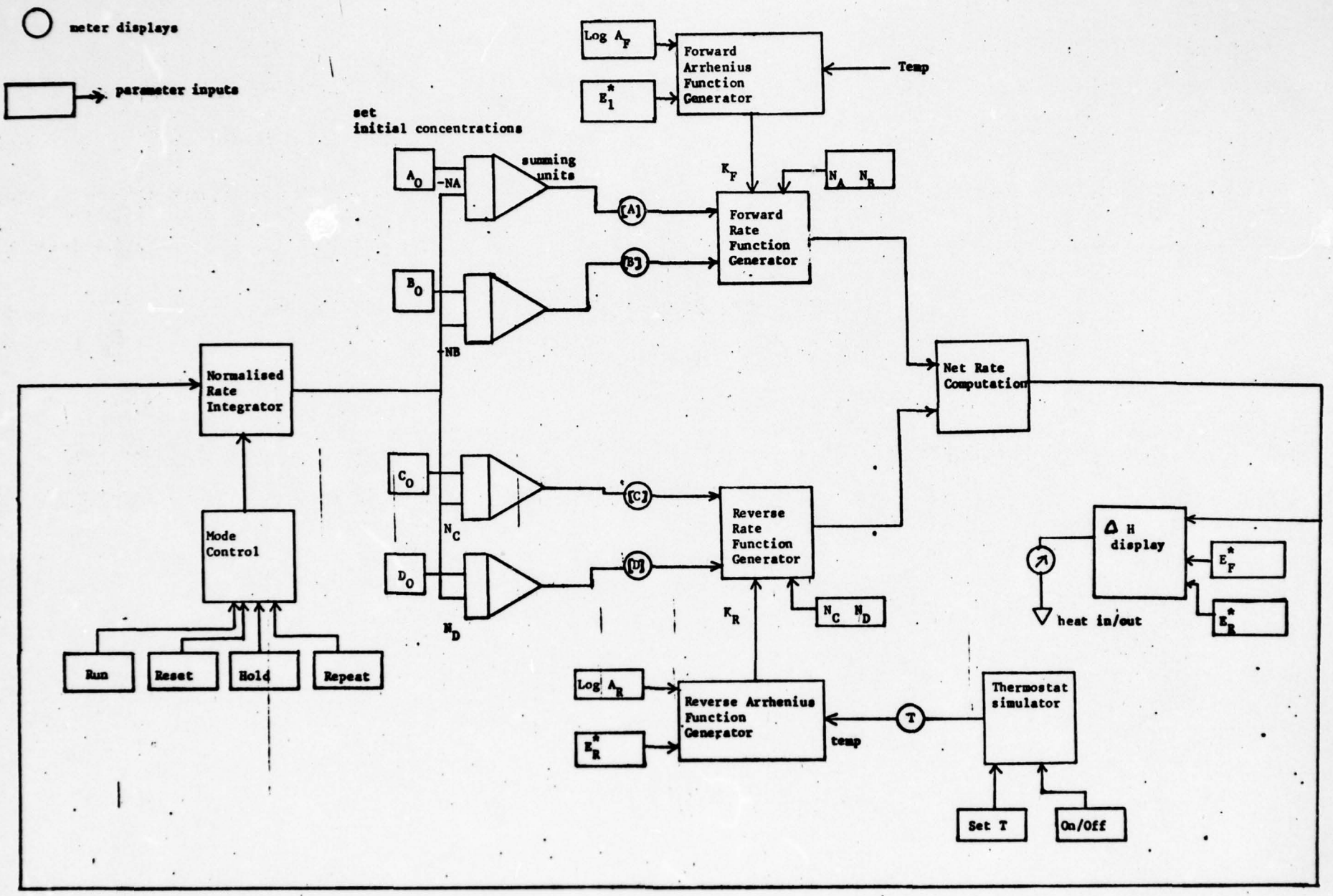


Fig 2 . Simulator Design 2 (alternative integrator arrangement).

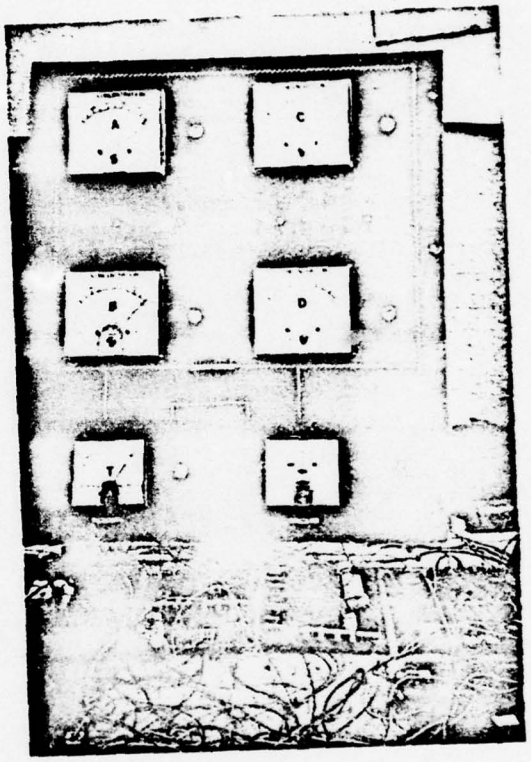


Fig 3: Prototype Reaction kinetics simulator

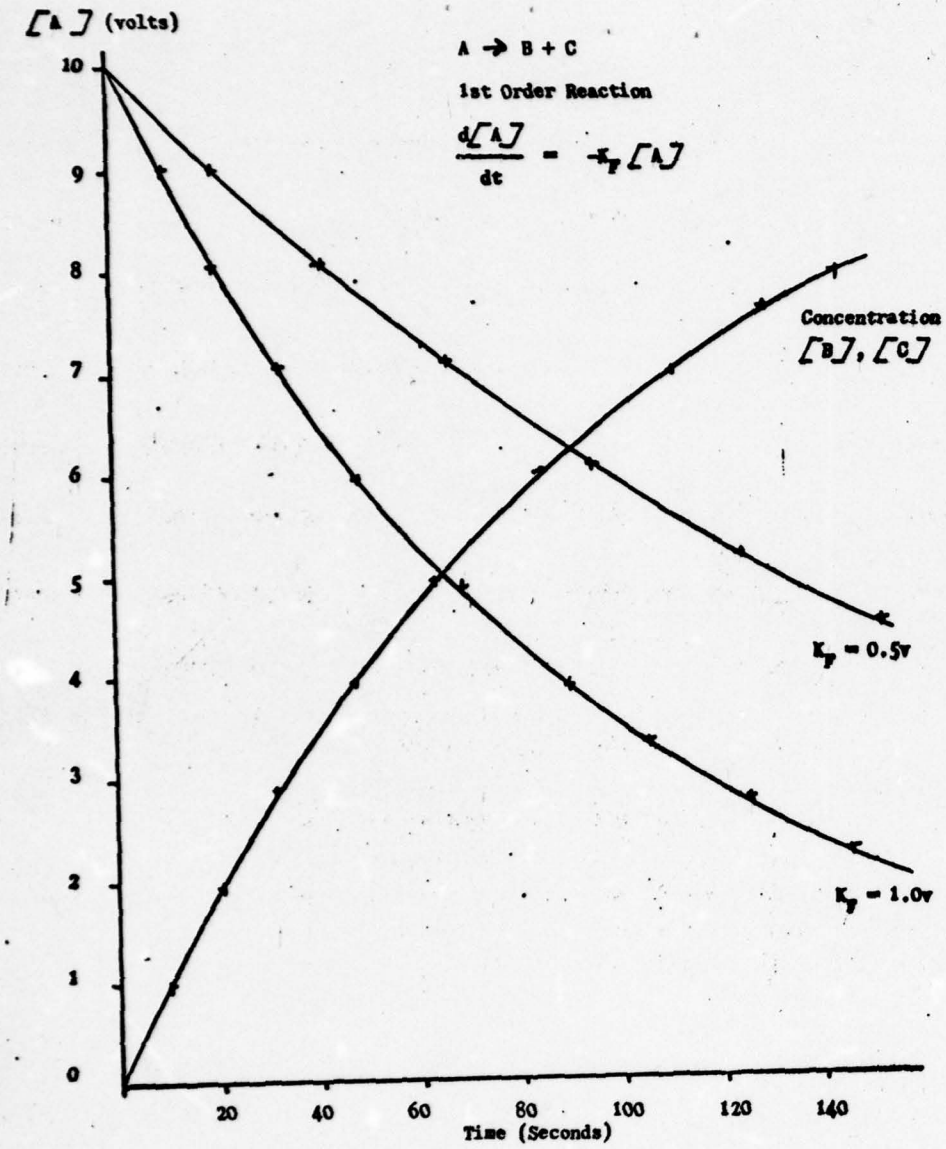
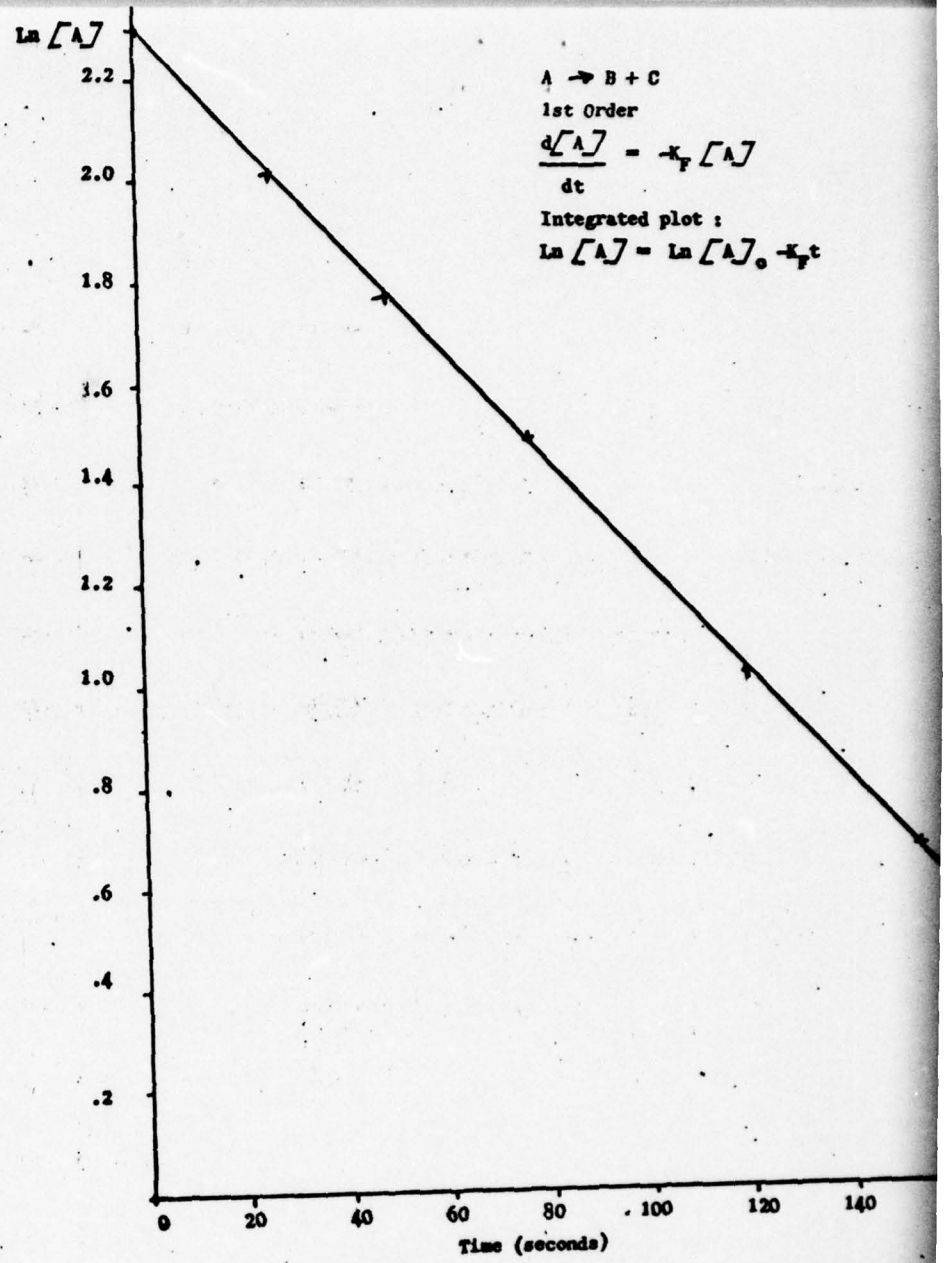
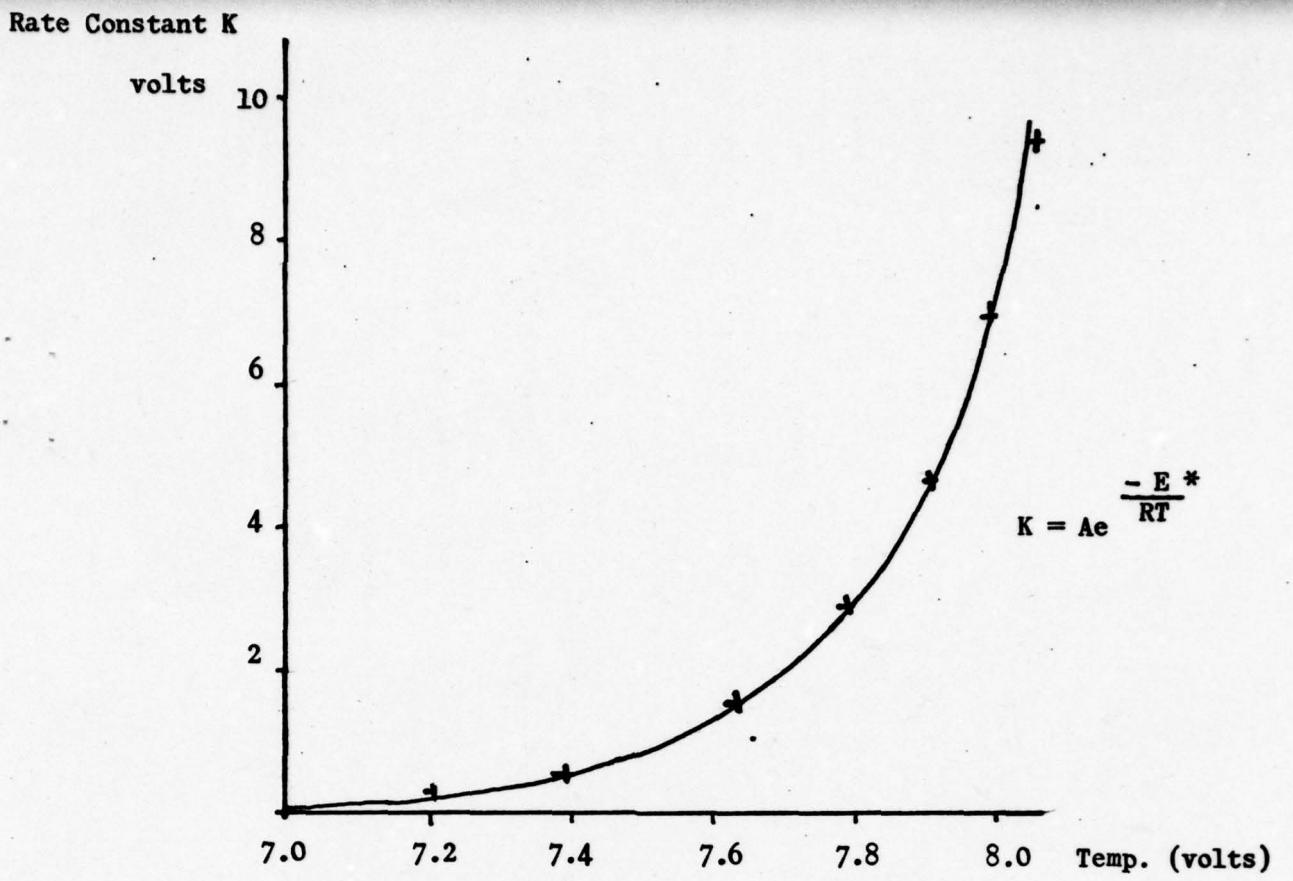


Fig. 4 Graphs of Simulator Performance (1st order reaction) obtained during scaling tests and performance evaluation. (See Appendix 4(a) for program listing).



(Curves drawn from computed values. Points marked + for measured values)



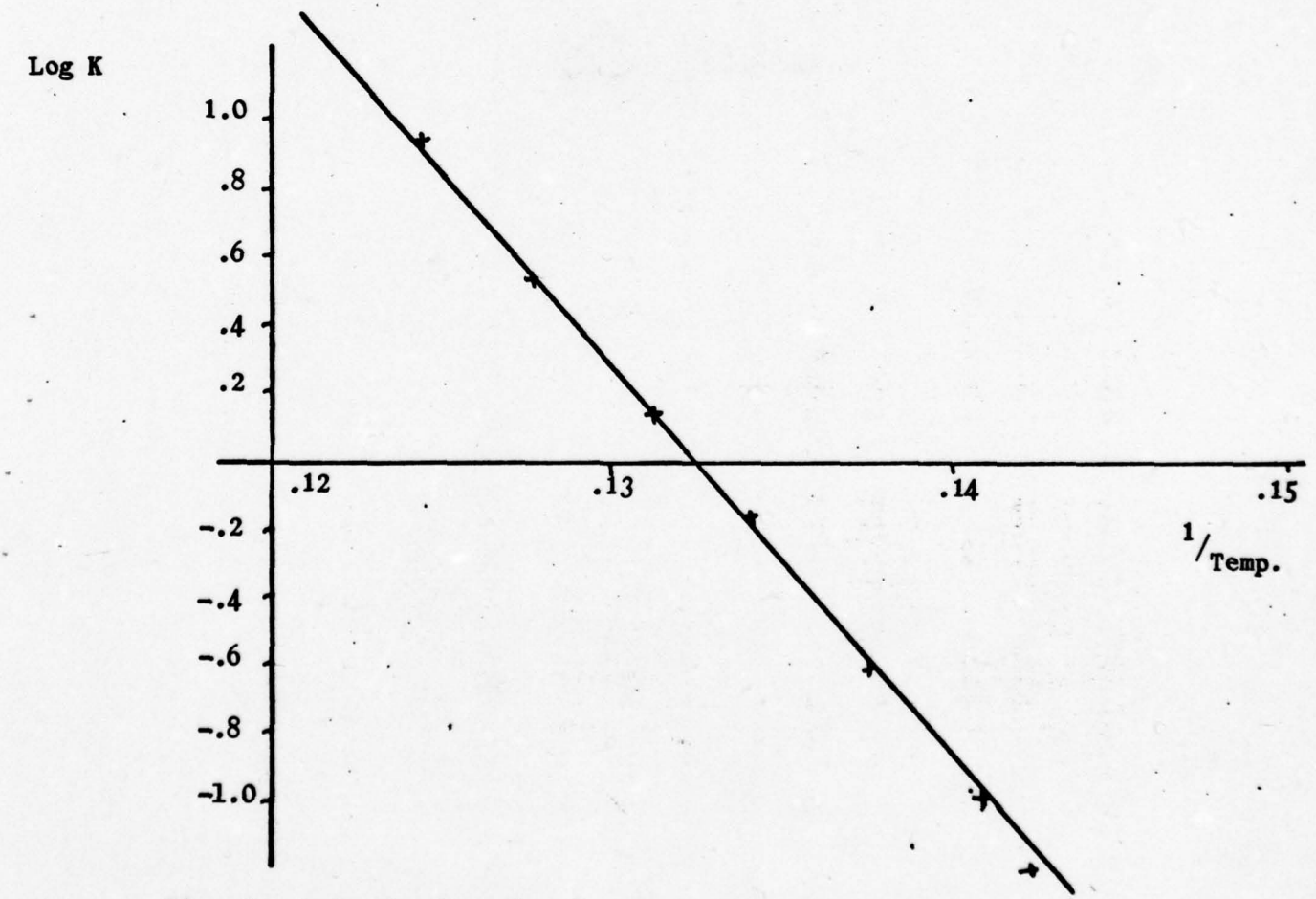
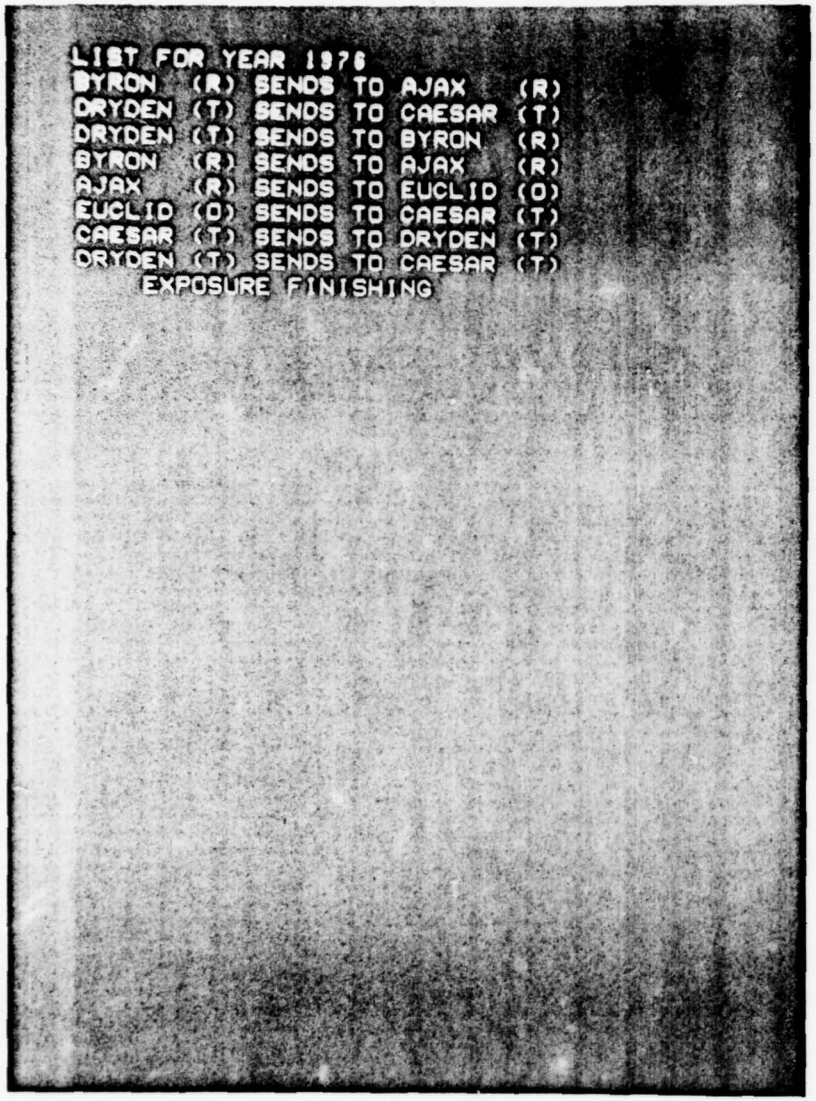


Fig. 5. Arrhenius Function Generator Performance.
(simulated temperature range 700-800°K)
(see Appendix 4b for program listing).



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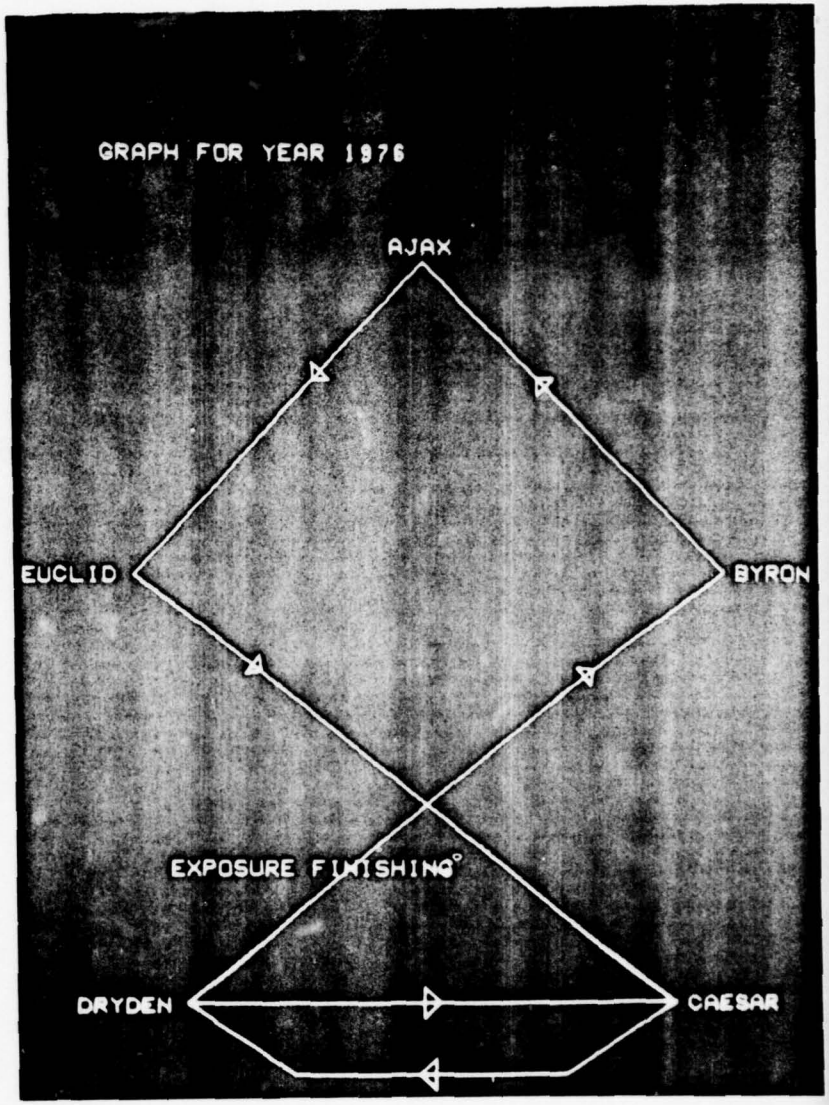
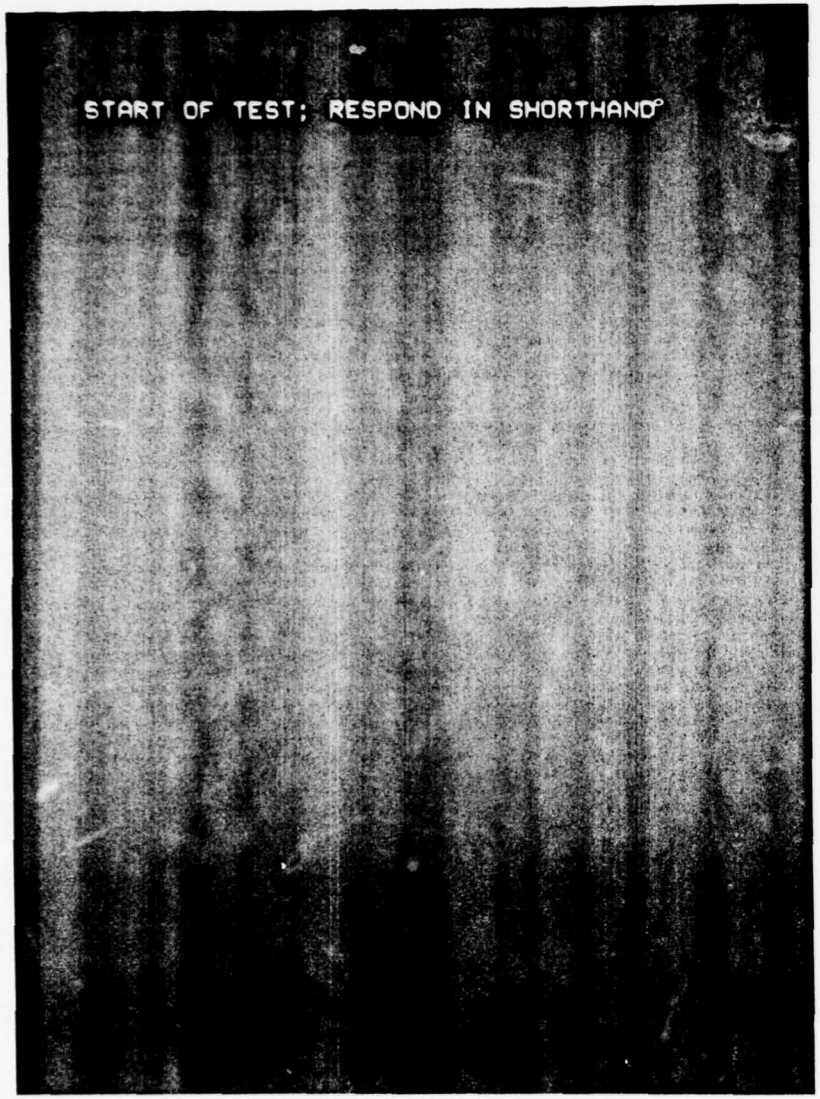


36(1) Transaction list for year 1976 (first of five) exposed for a fixed period. Letters, R, O, T, represent countries Ruritania, Olympia and Transylvania.

6(2) The graph for the same year. Exposed for the same period as the list.



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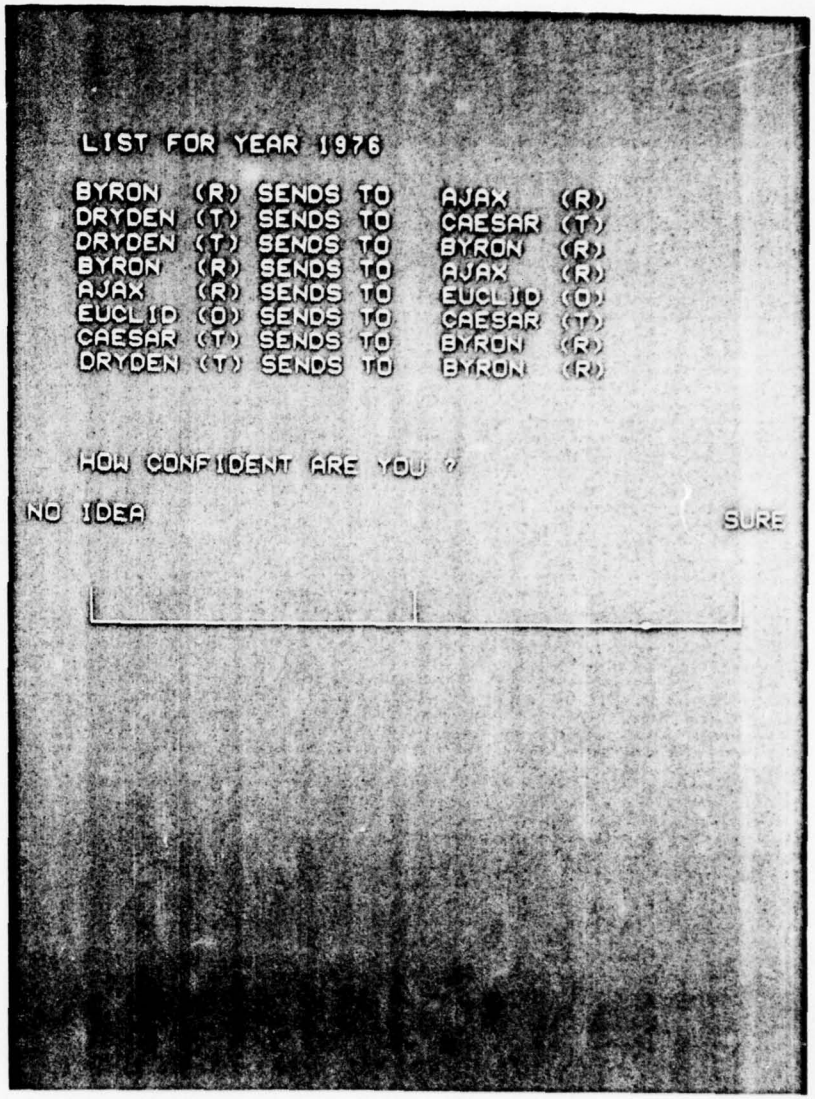
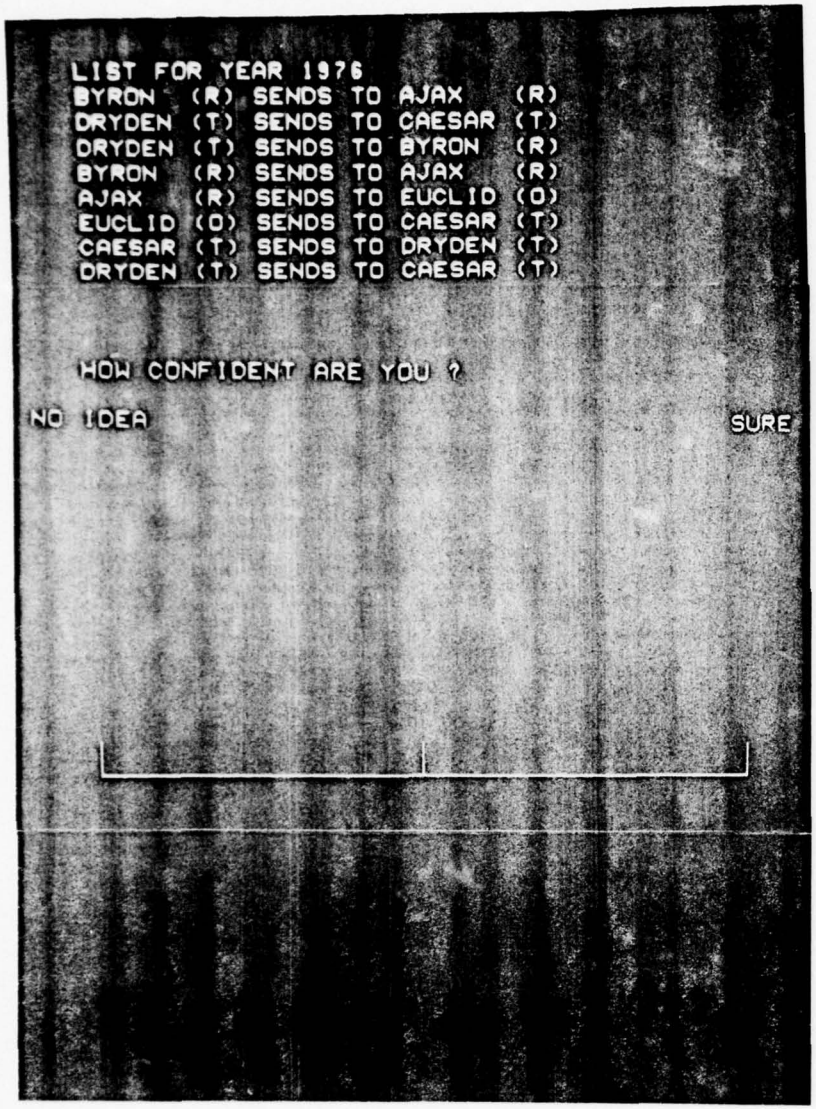
(3) Subject is asked to reproduce the transaction list for 1976. As a shorthand, the subject types only initials of spies or countries; the computer then expands these to give full names on screen.



6 (4) On completion of the 8 lines the subject is asked to indicate degree of confidence in his/her list by placing cursor along the bar using space or backspace. In this case there is an error in line 7.



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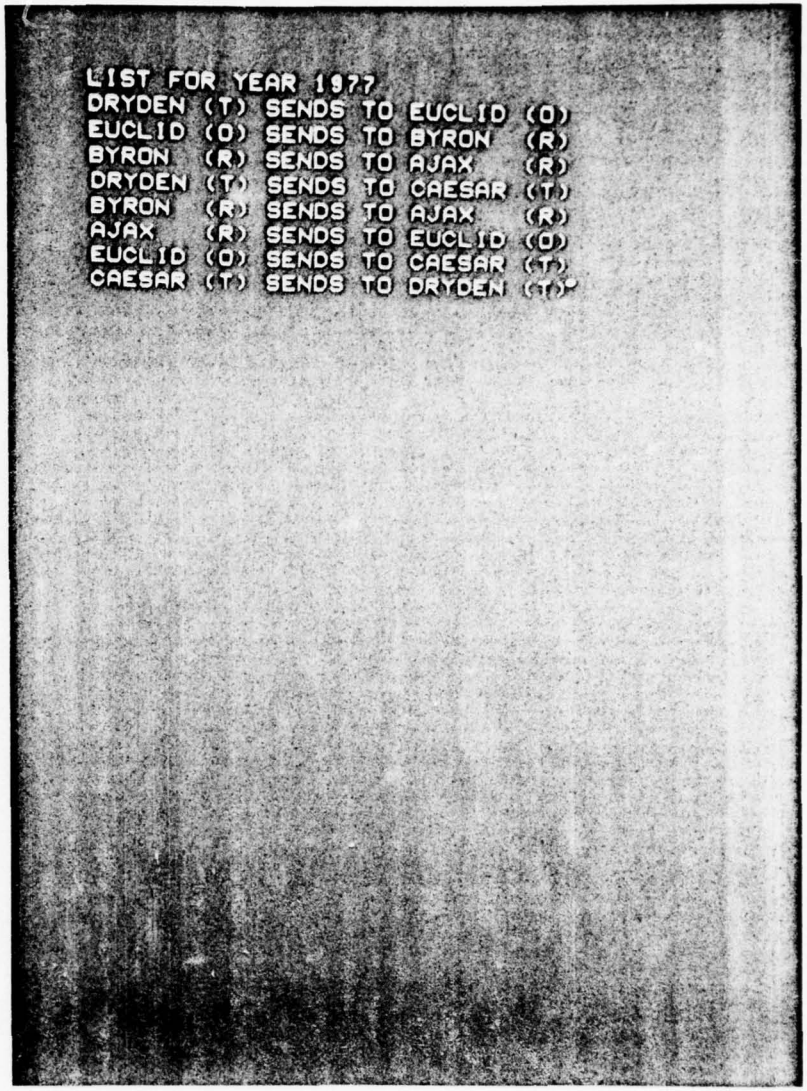
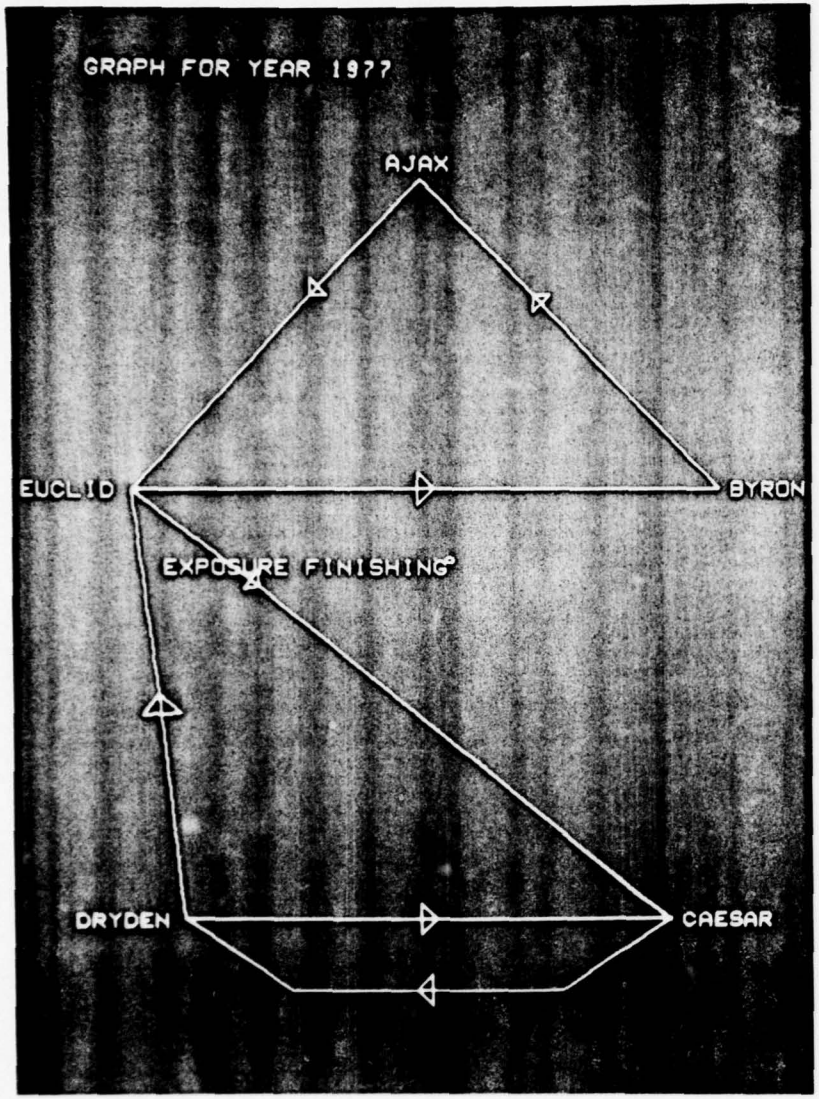


6(5) Since the response was not completely correct the list of 6(1) is re-presented and trials continue until an entirely correct response is obtained as shown above. Confidence is recorded for each trial.

6(6) Since subject has correctly reproduced list for 1976, program moves on to 1977 and exposes the appropriate transaction list.



6(7) As before the graph for 1977 is now exposed for the usual period. The subject is again asked to reproduce the list and the procedure to obtain a completely correct response is repeated.

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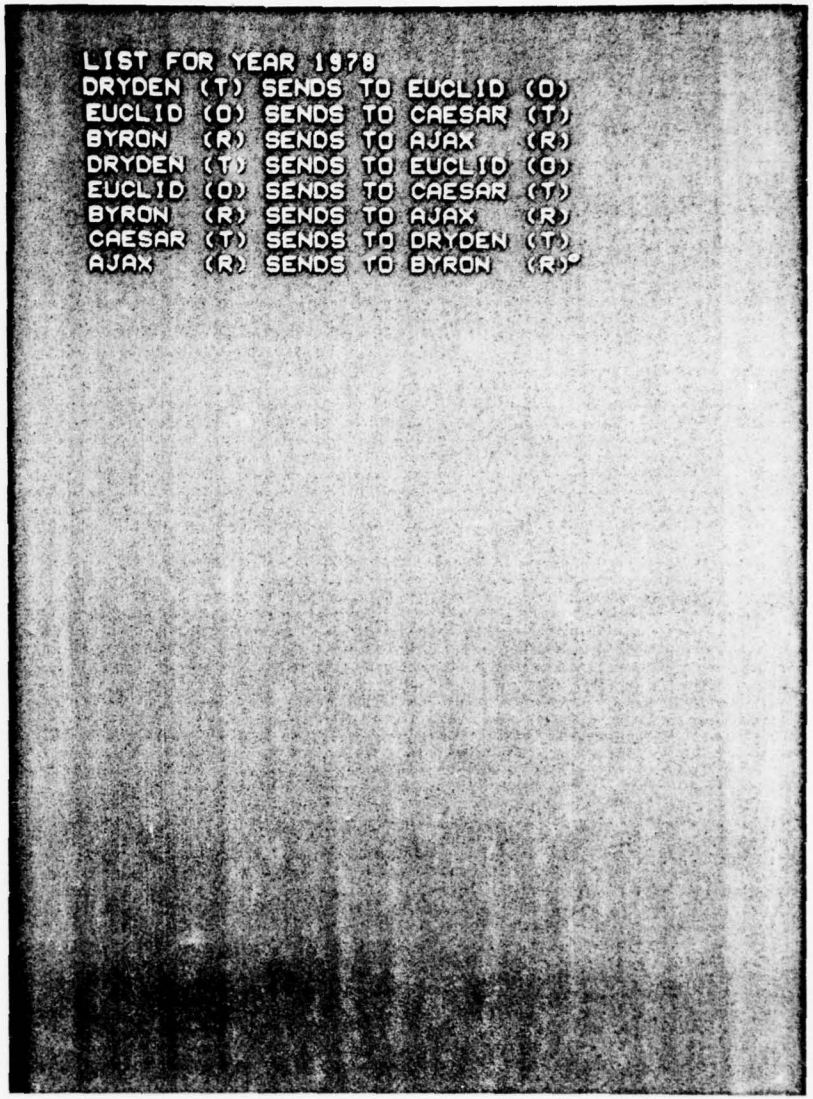
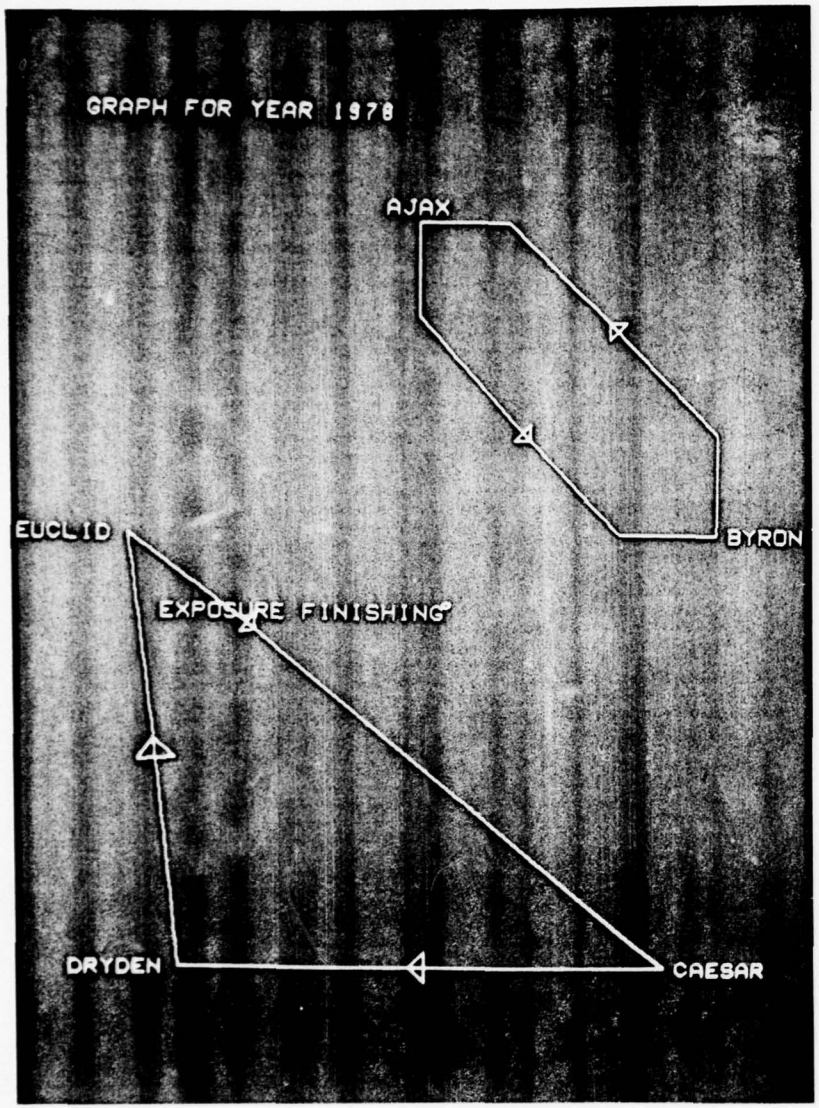


6(8) Transaction list shown to subject for year 1978.



6(9) Graph for 1978.

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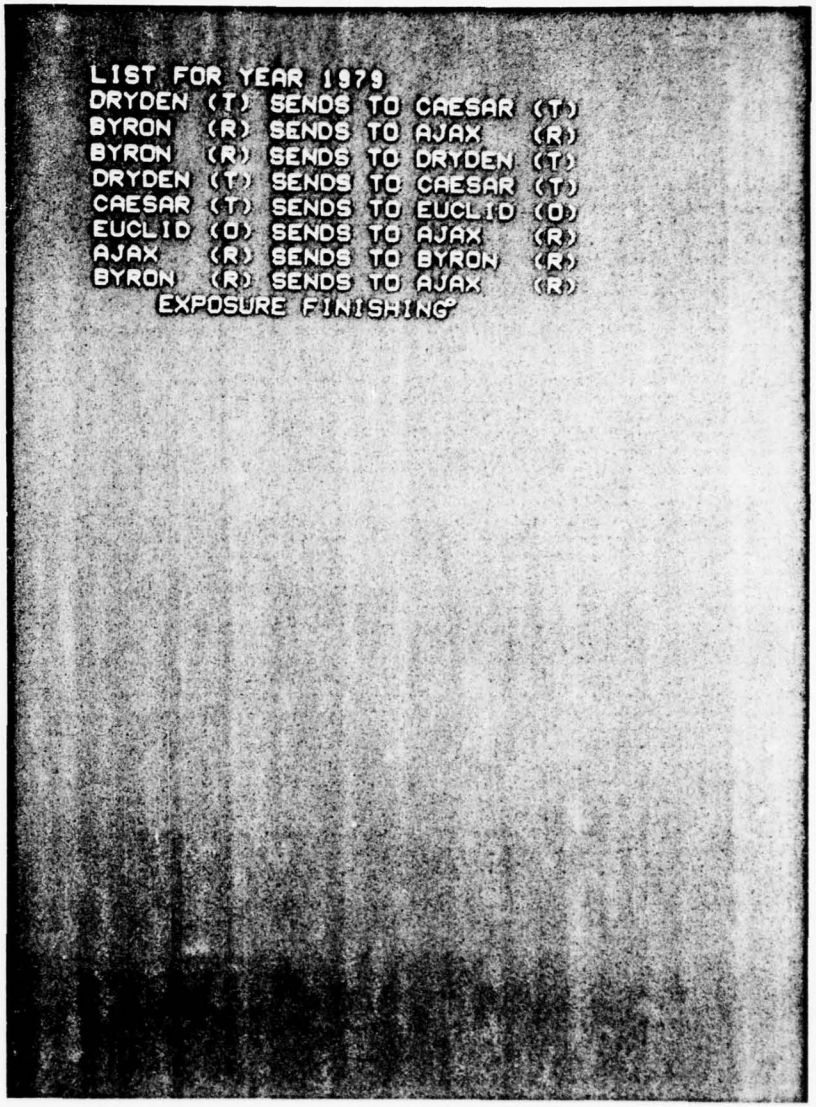
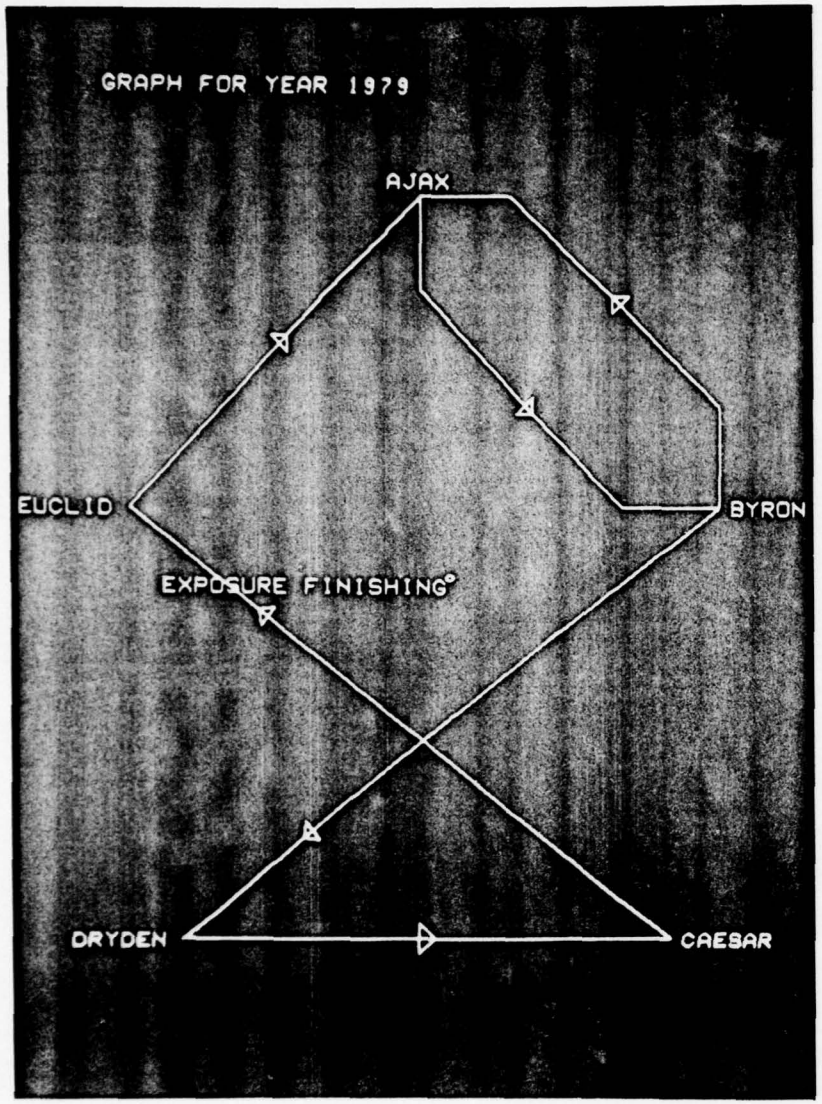


6(10) List for 1979.



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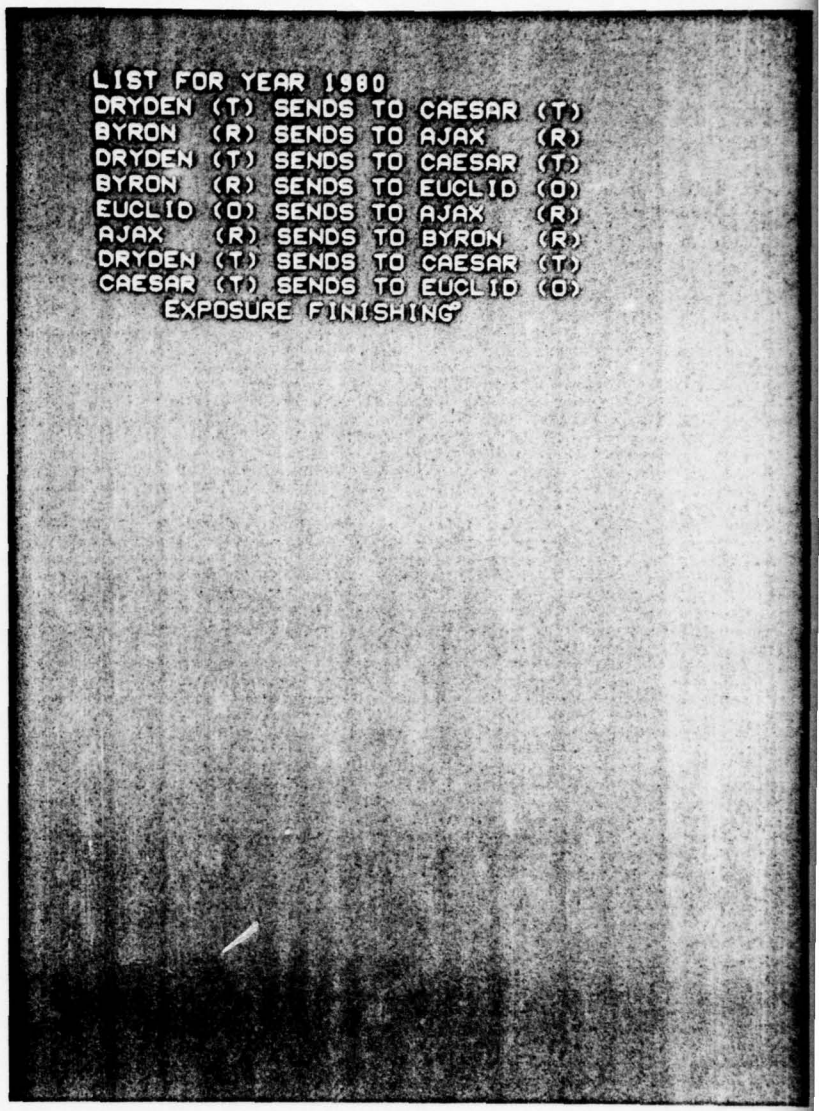
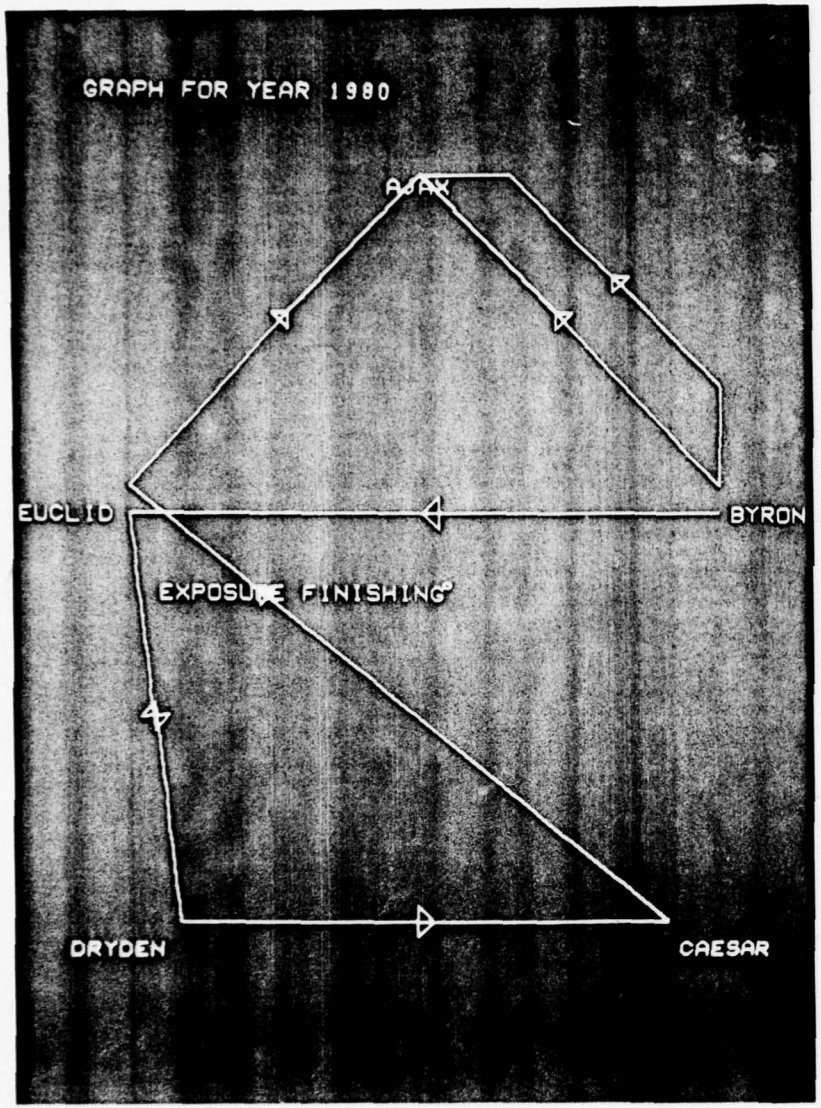


6(11) Graph for 1979.

6(12) List for 1980.



6(13) Graph for 1980.

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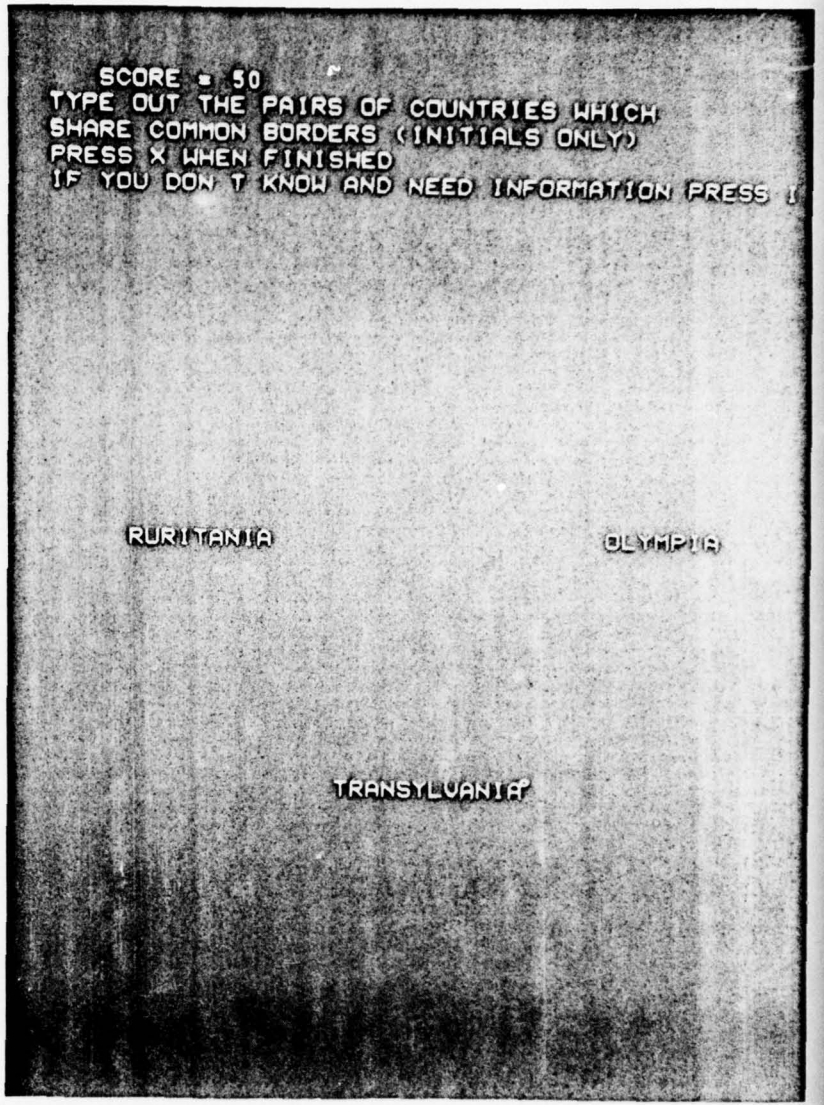
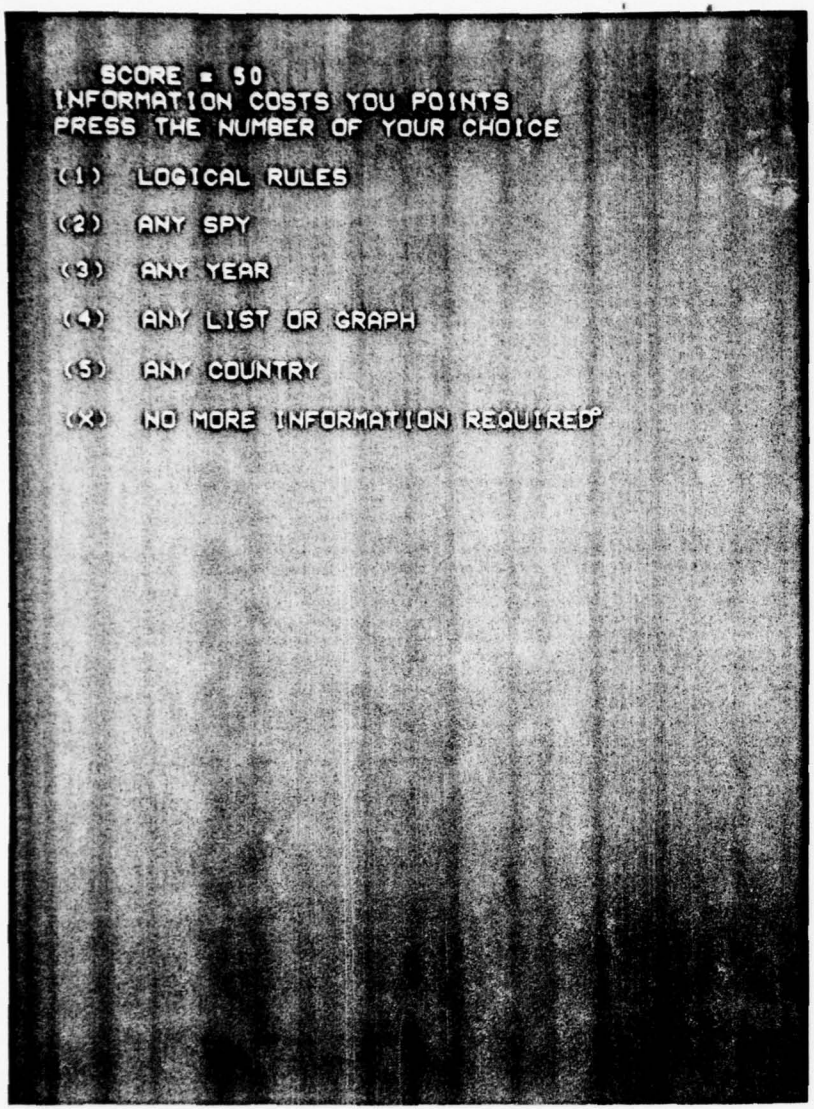


6(14) After recalling all lists correctly the subject is asked the question shown above. In this case letter I was pressed for information. The following photographs show the "menu" of information.



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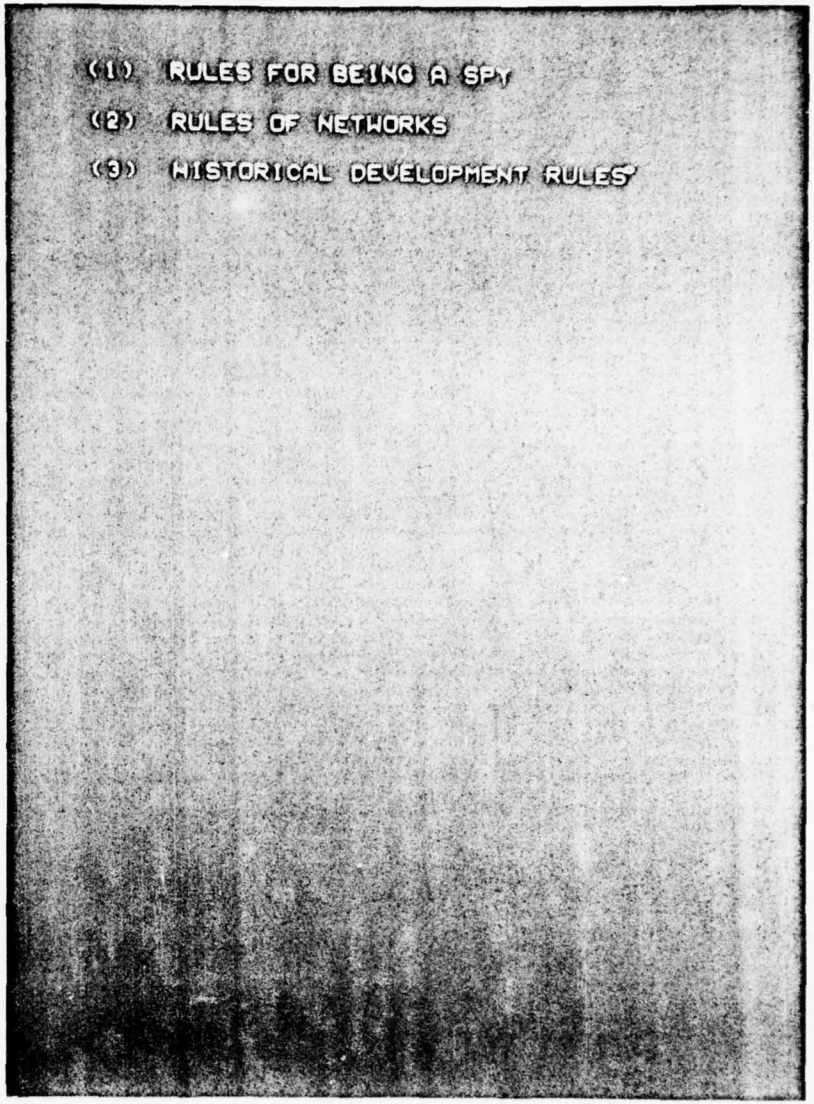
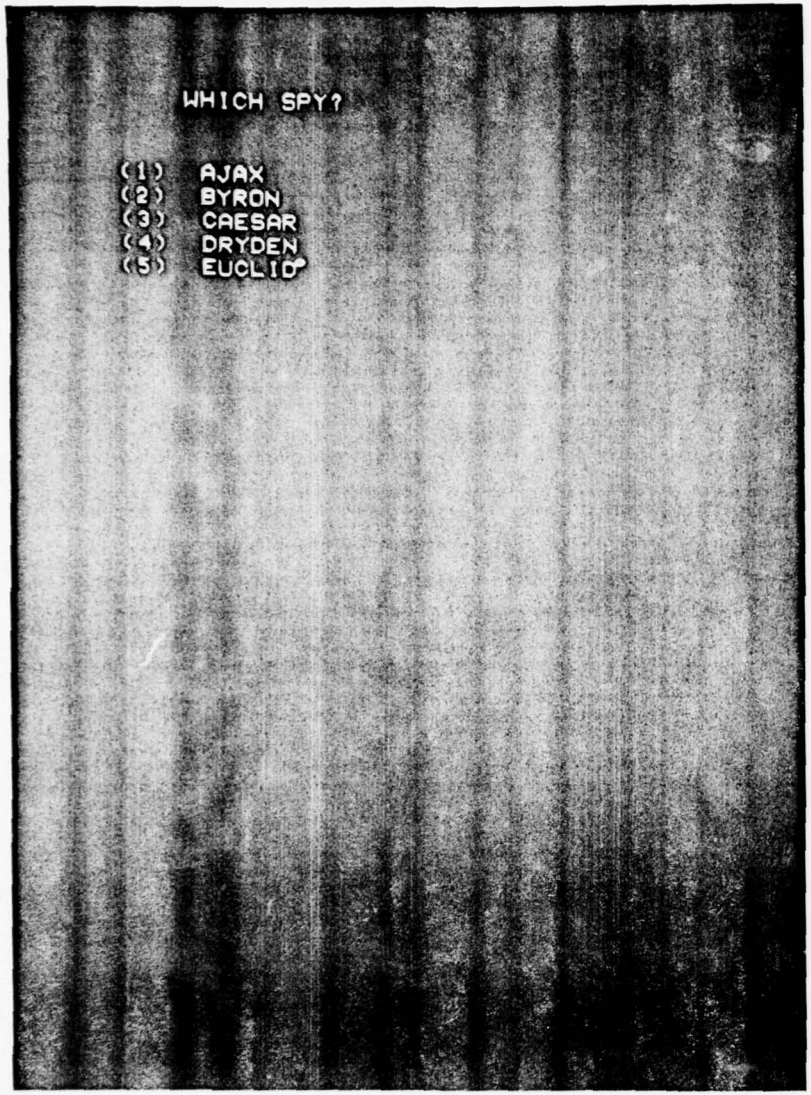


(15) "Score" shown is not test score but is decreased for each item of information shown and is intended to encourage provident search. In this case number 1 was pressed for logical rules.

6(16) "Logical rules" category is subdivided as shown in this frame. In this case no. 1 was pressed for "rules for being a spy". Information then appeared on slide projector.



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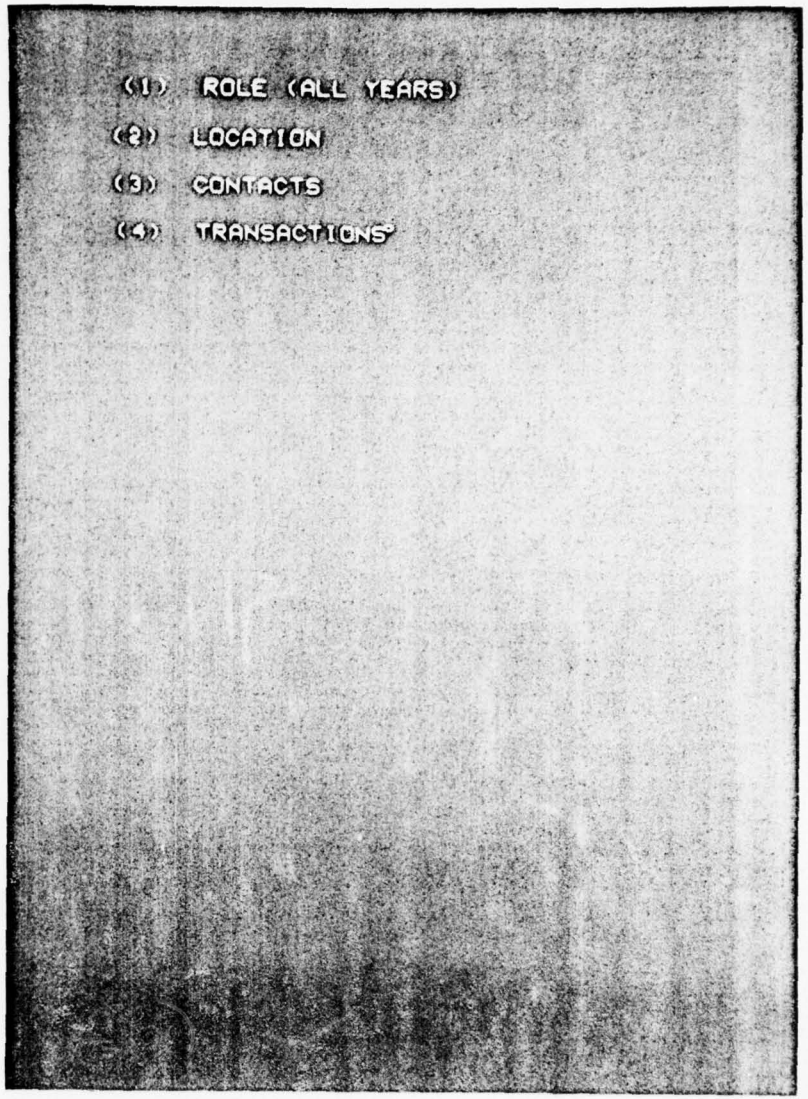
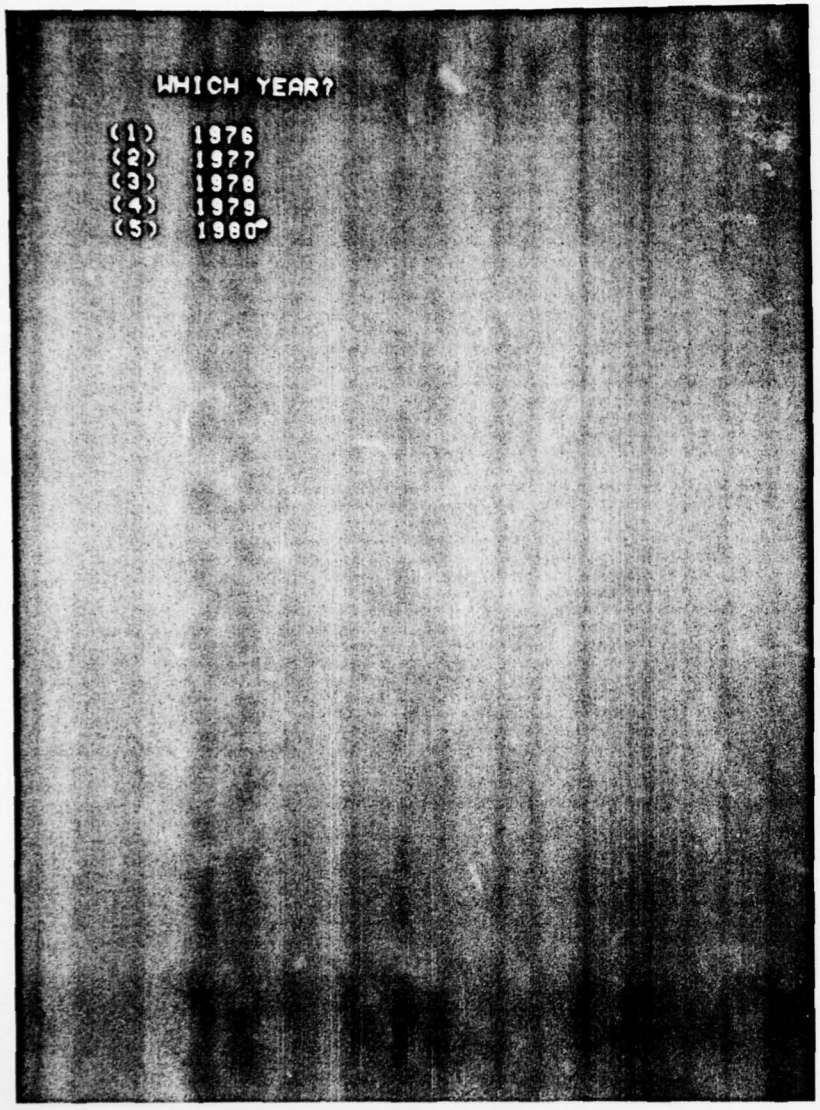
6(17) After fixed exposure of slide, frame 6(15) was re-displayed. Score had decreased to 49. Subject then pressed no. 2 (6(15)) and the choice shown above was then displayed.



6(18) Having chosen a spy in previous frame, the further subdivisions above were presented. On pressing any one of these numbers, an appropriate slide would have been shown.



6(19) Having selected any year from 6(15) the subdivisions shown above were presented.

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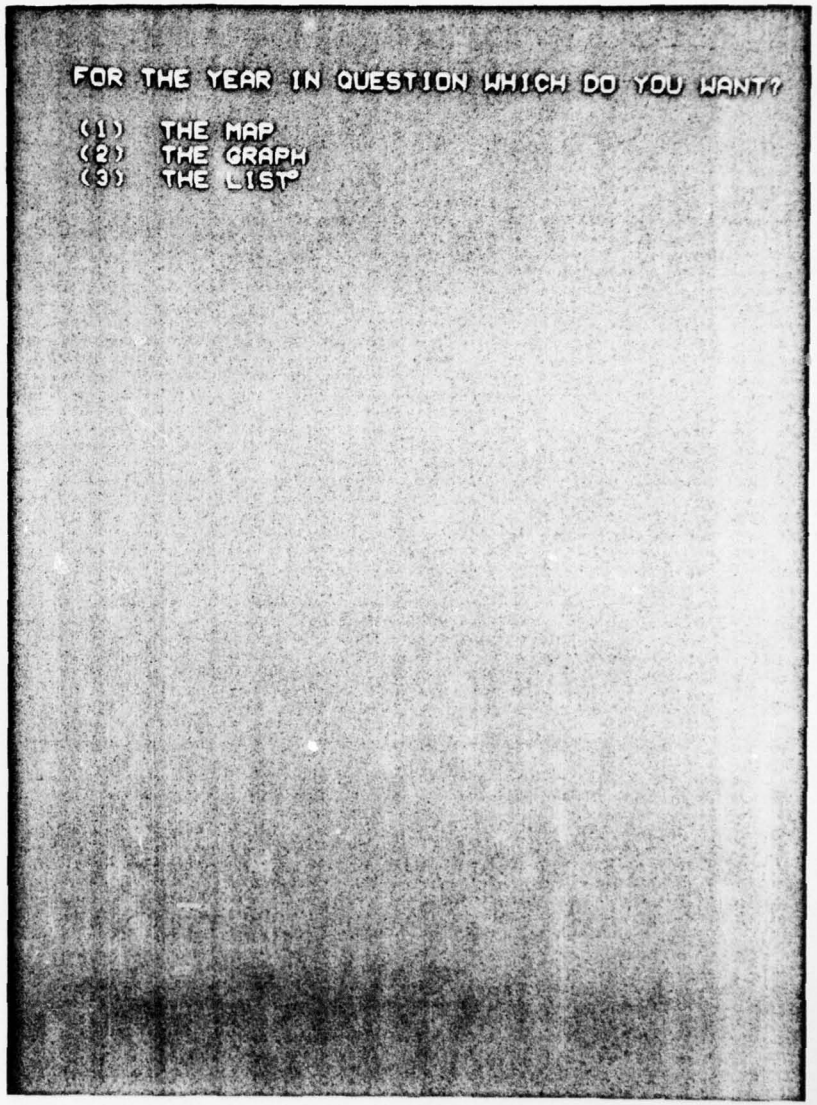
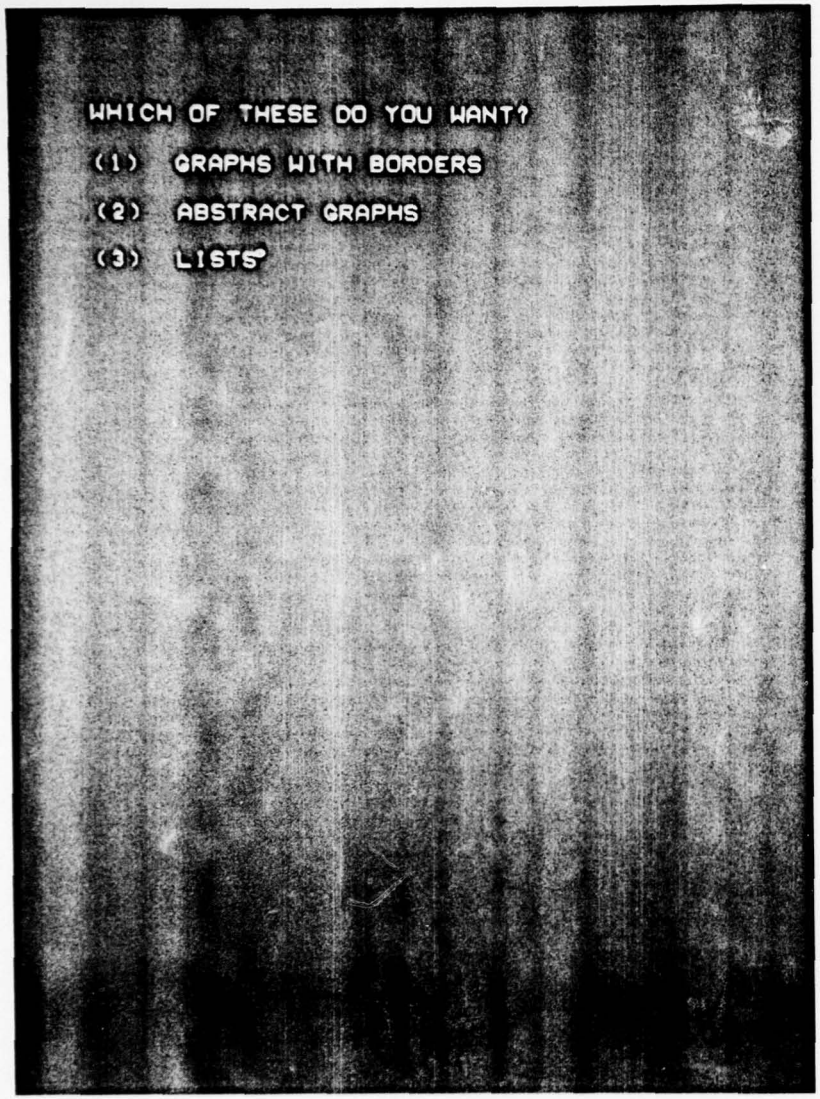


6(20) The year chosen is further subdivided as shown above. On pressing any one of these numbers, an appropriate slide is presented.



6(21) Having chosen "Any List or Graph" from 6(15) these choices are given.

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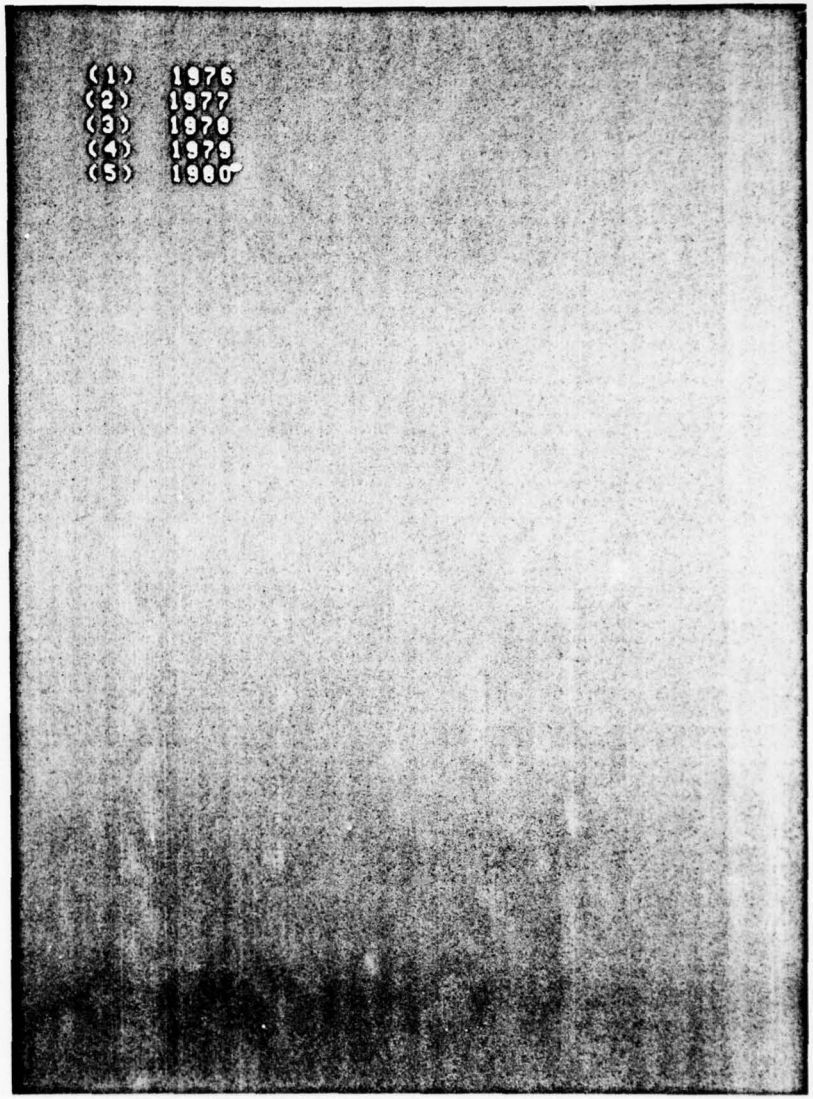
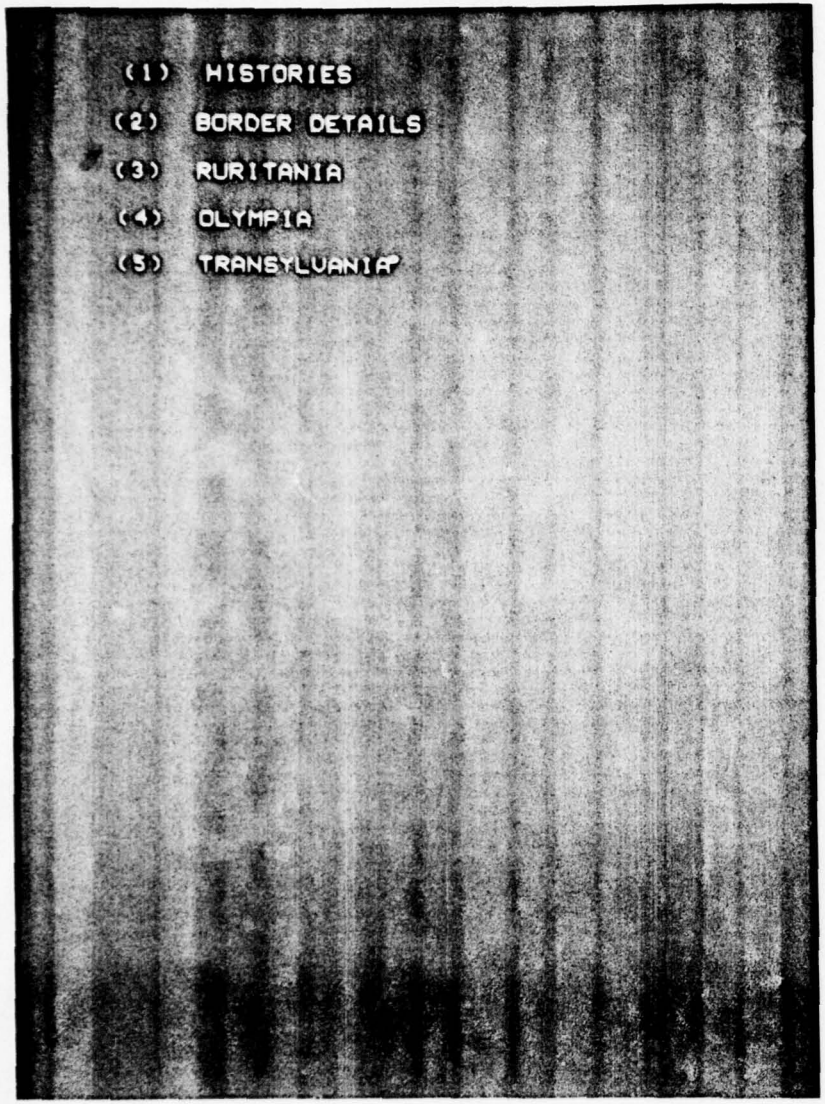


6(22) When a choice was made in the previous frame. The subject indicated which year he wanted and the appropriate slide was shown.



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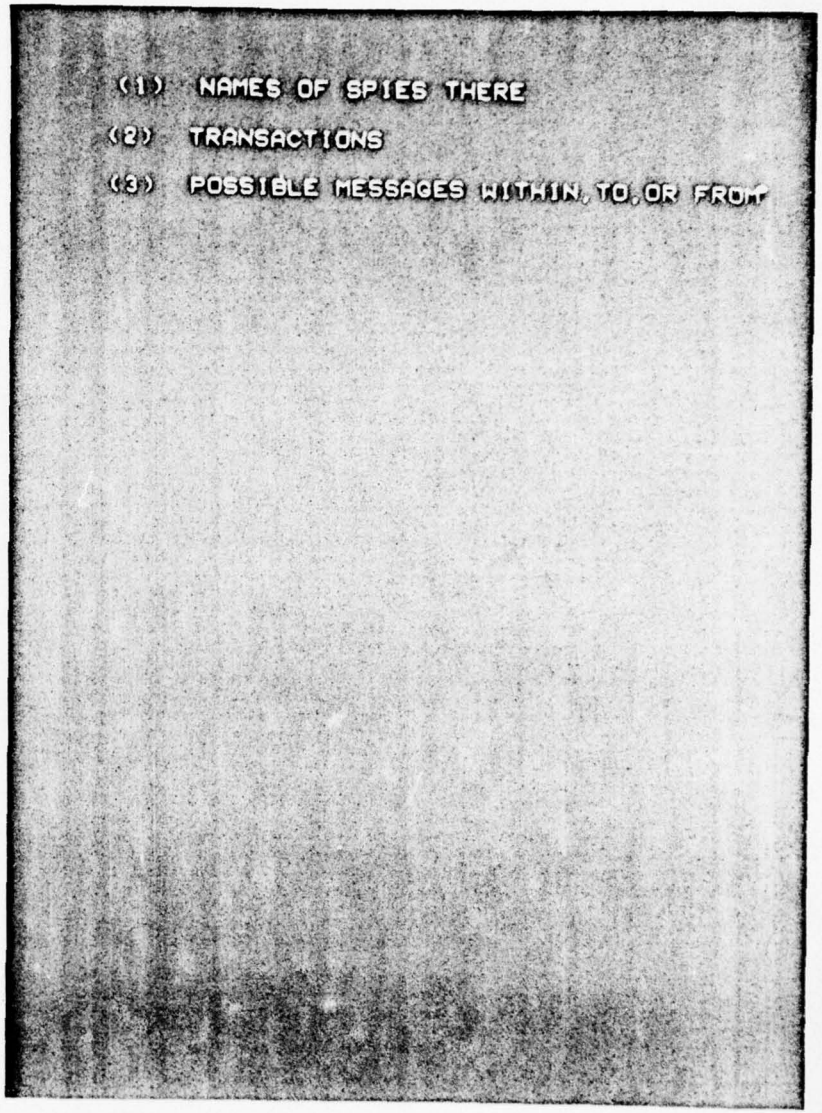
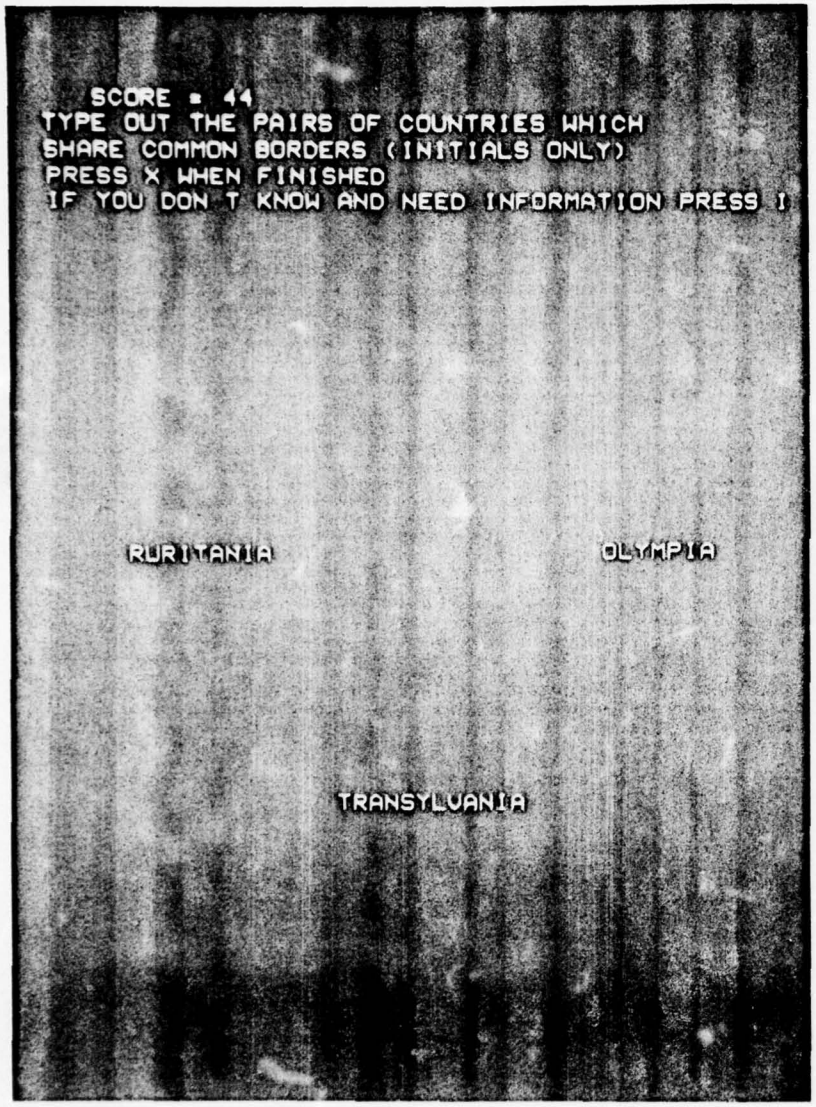


6(23) Having chosen "any country" from frame 6(15) these options were provided. Choice of (1) or (2) causes a slide to be presented immediately. Choice of (3), (4) or (5) leads to further subdivision.

6(24) These options would be shown if (3), (4) or (5) were pressed in response to the previous frame. Choice of one of these brings on an appropriate slide.



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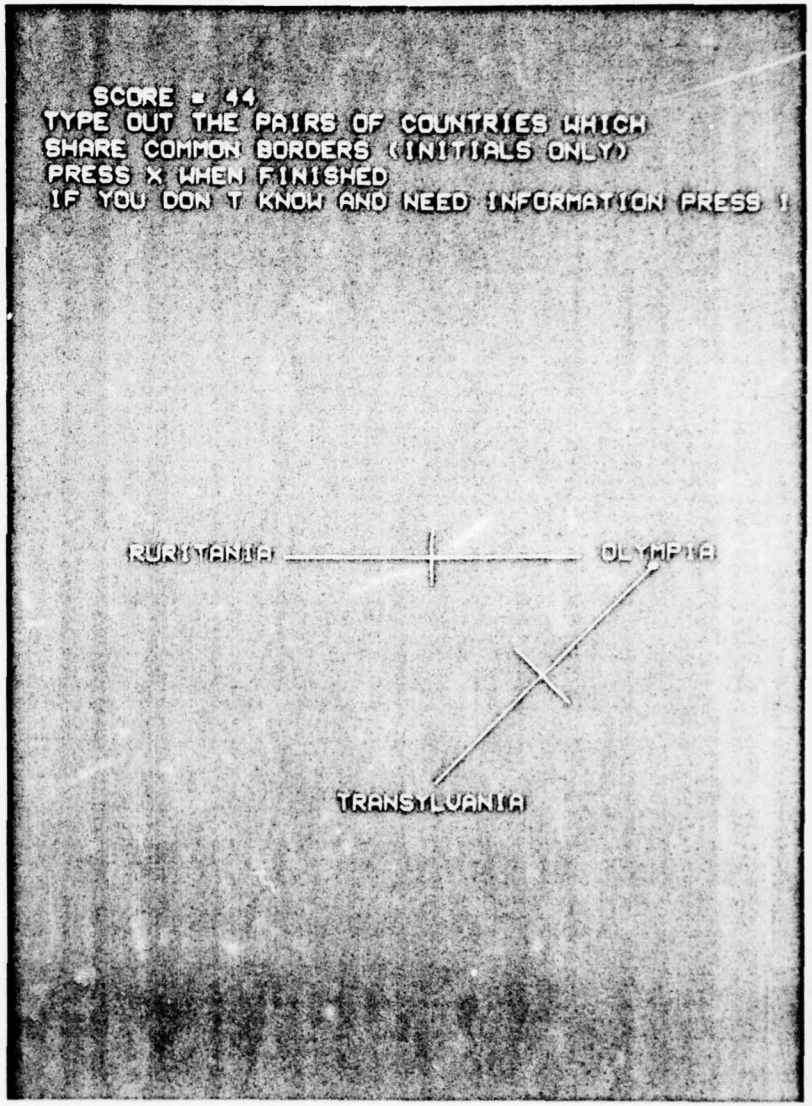
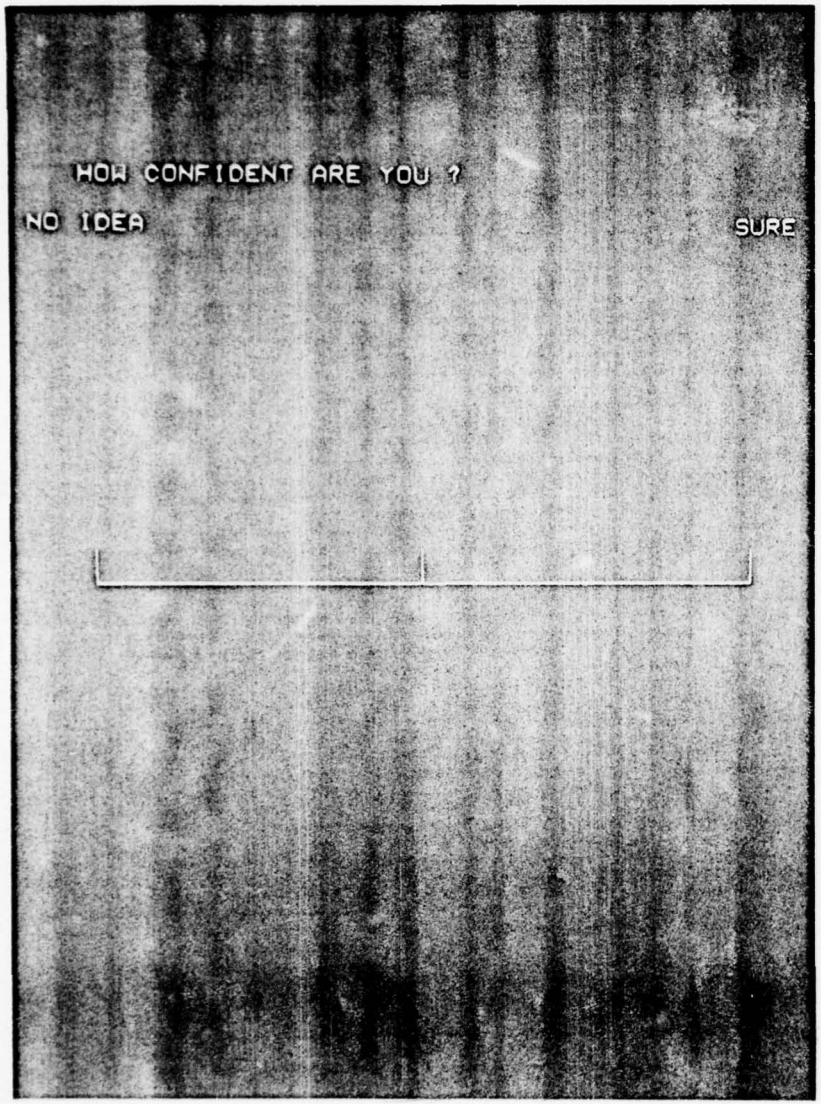


6(25) Having seen all the information he required, subject would have pressed (X) to move on at the next display of frame 6(15). The question he had deferred would then have been re-displayed as shown above. Note decreased score (44).

6(26) Subject responded by pressing two pairs of initials: R - O and T - O. The symbolic borders appear automatically after each pair. Subject then pressed X to show he had finished.



6(27) As in the earlier phase of the test, subject is asked for a confidence estimate after completing each response.

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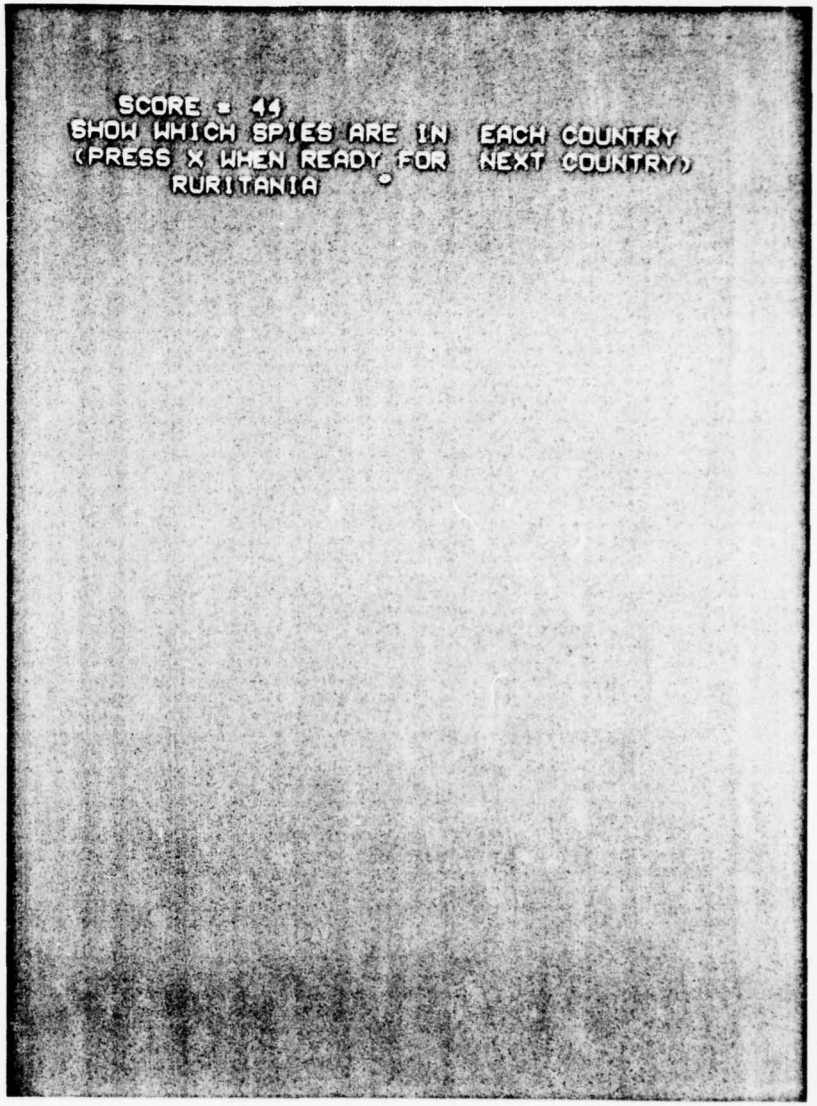
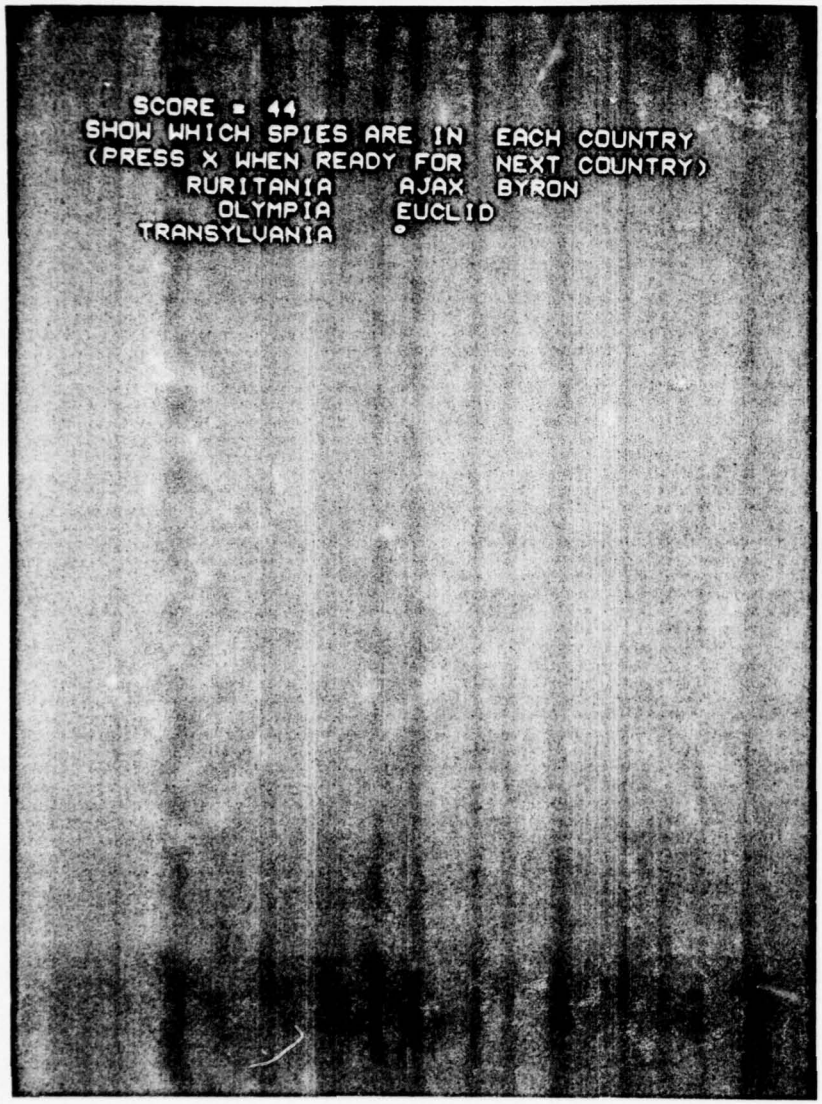


6(28) The next question is as shown above. As before the initials only are used for convenience.



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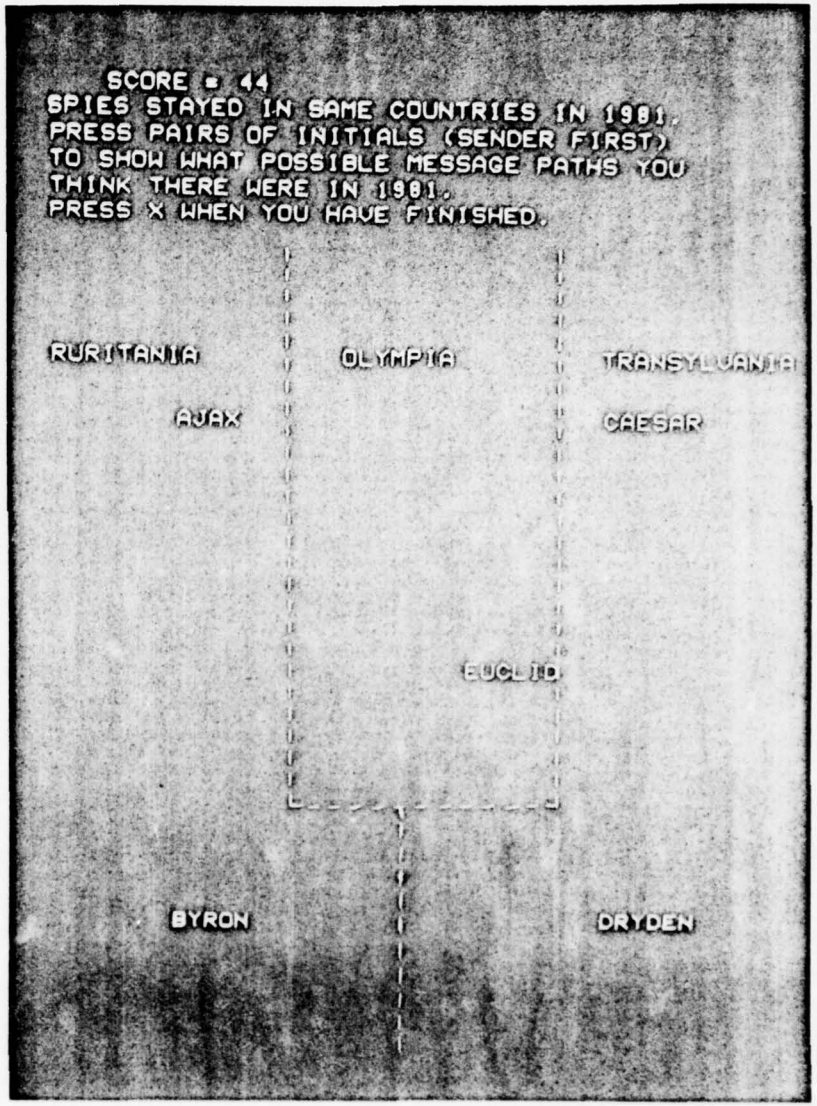
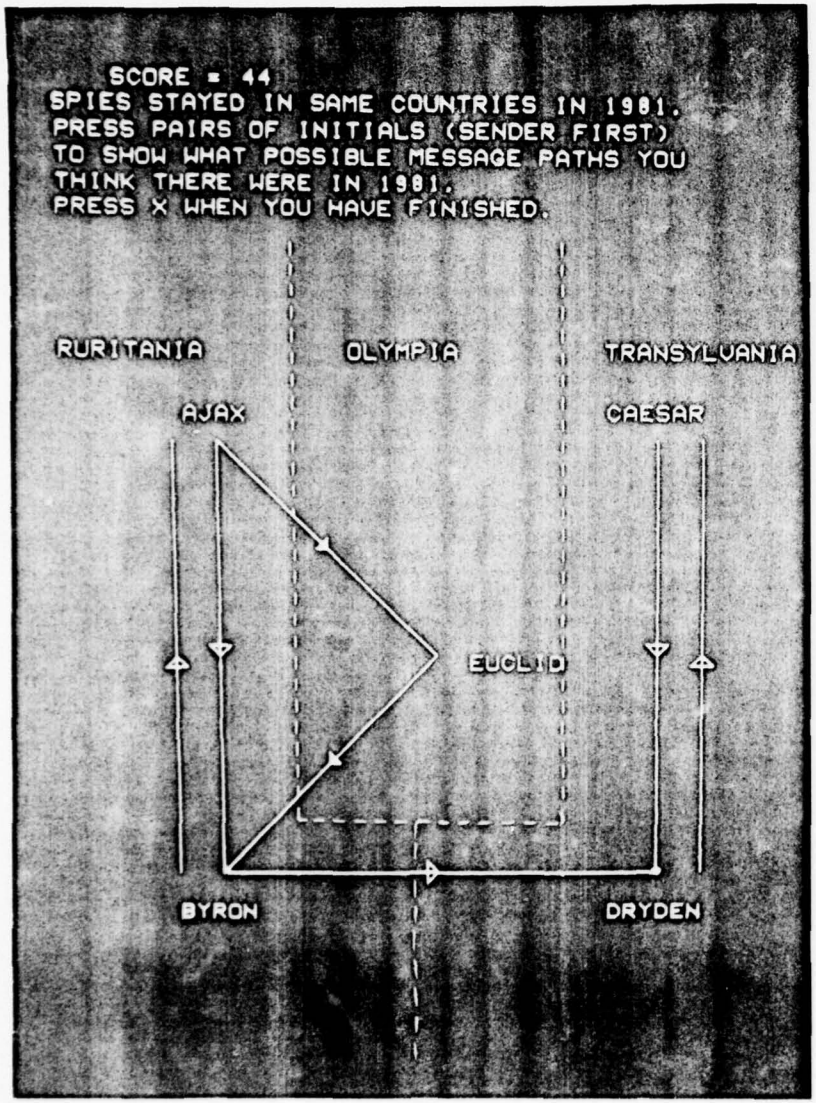


6(29) Full names are printed automatically. Subject has to press X to move on to second and third countries. In any event, program moves on to usual confidence estimate after five names have been indicated.

6(30) Next question is as shown. Score is shown since, if the prediction is not considered satisfactory, the information menu will be re-presented and a further attempt then requested.



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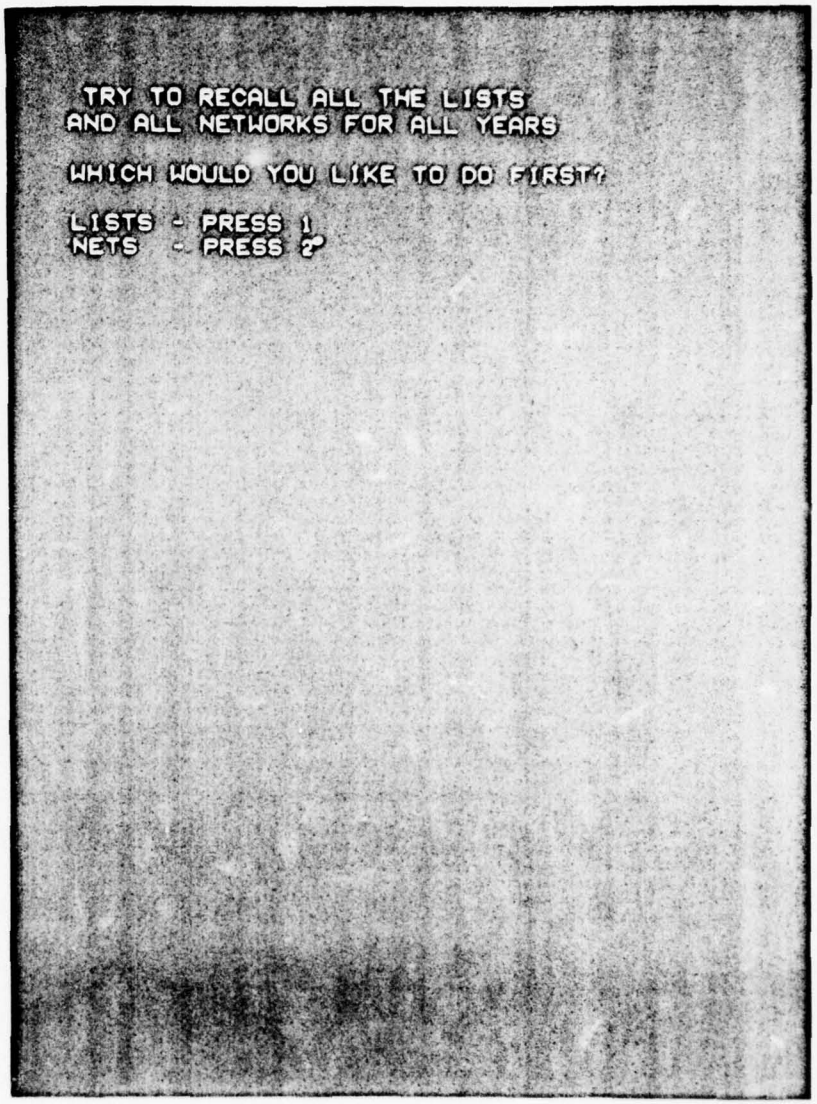
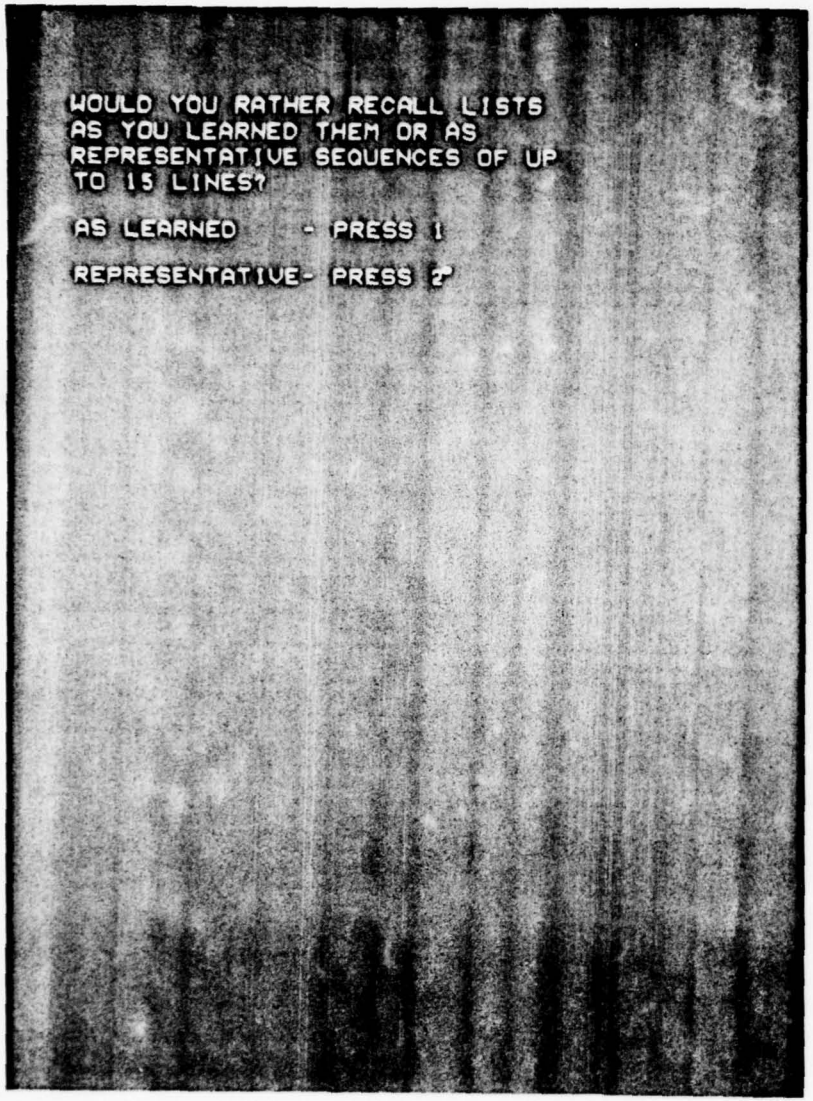


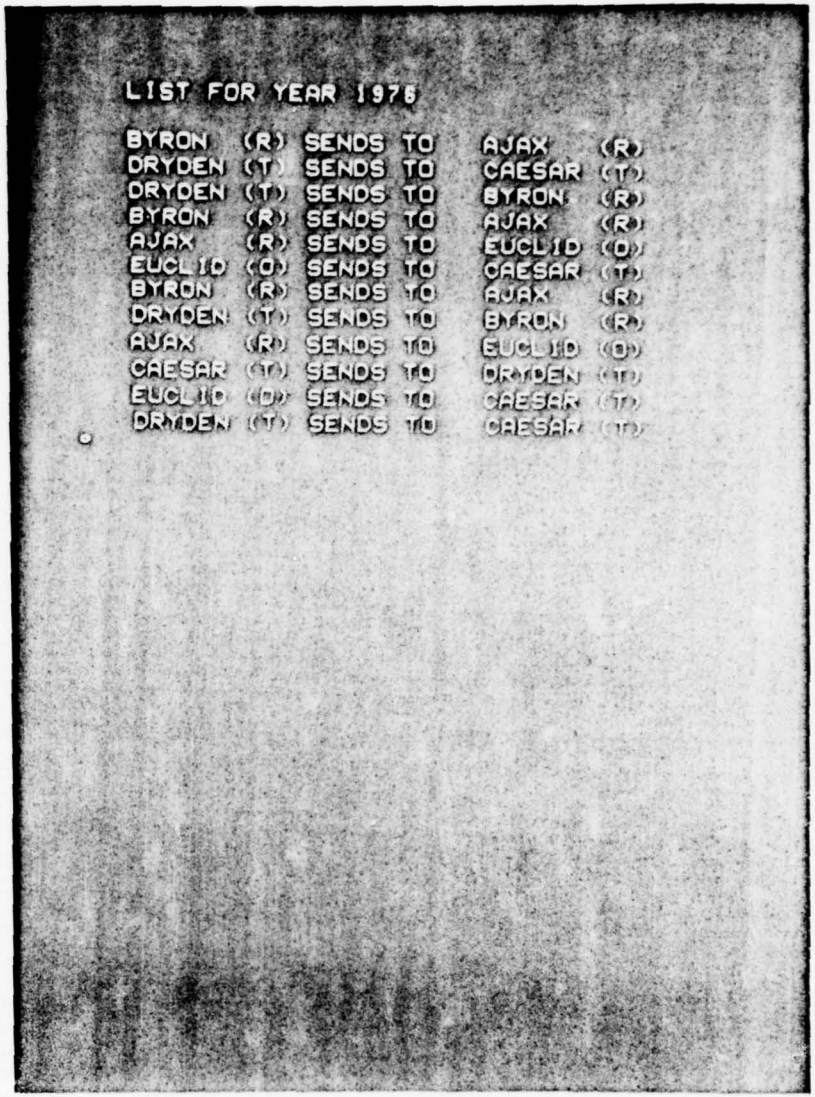
6(31) Shows this subjects response. Although initials only are pressed the lines and correctly directed arrows are presented automatically. This prediction was accepted as satisfactory. Re-presentation of the menu and another attempt were therefore unnecessary.

6(32) After a confidence estimate for the prediction the subject was then able to choose which of the remaining questions to attempt first; as shown above. In this case he chose option 1.

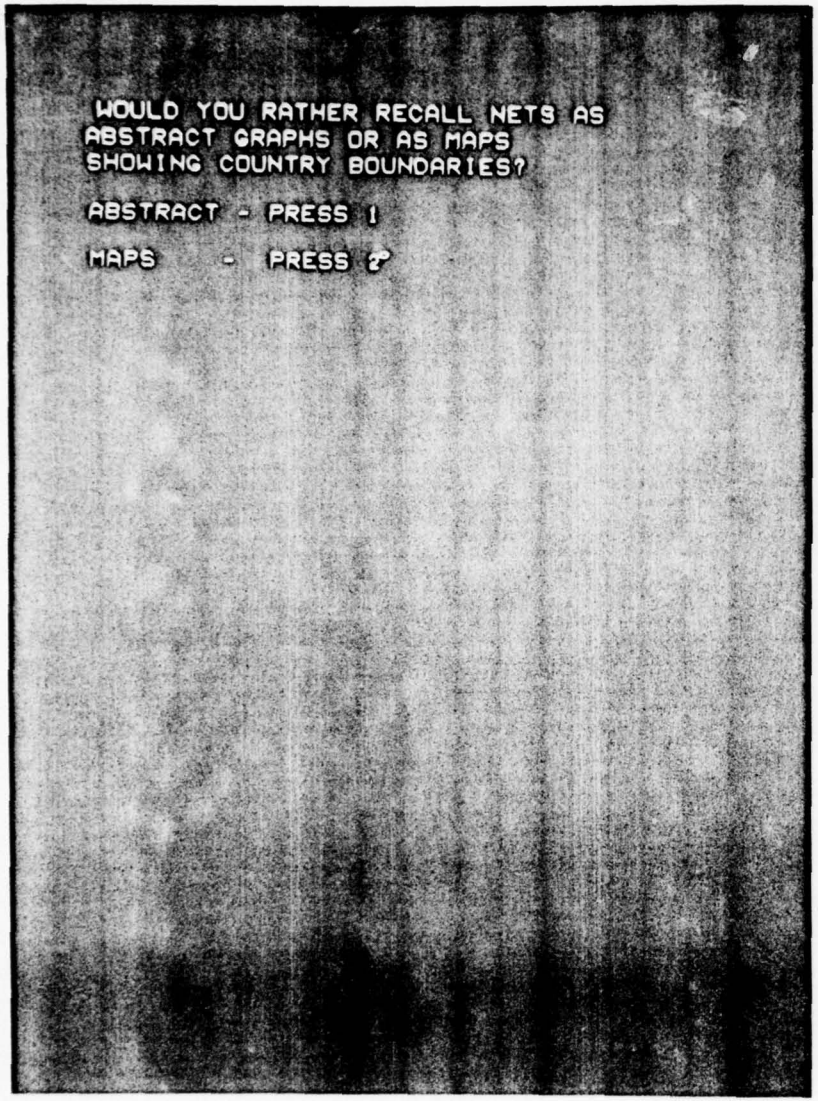


6(33) Subject has a further choice at this point as shown above. He chose option 2 on this occasion. (representative lists).

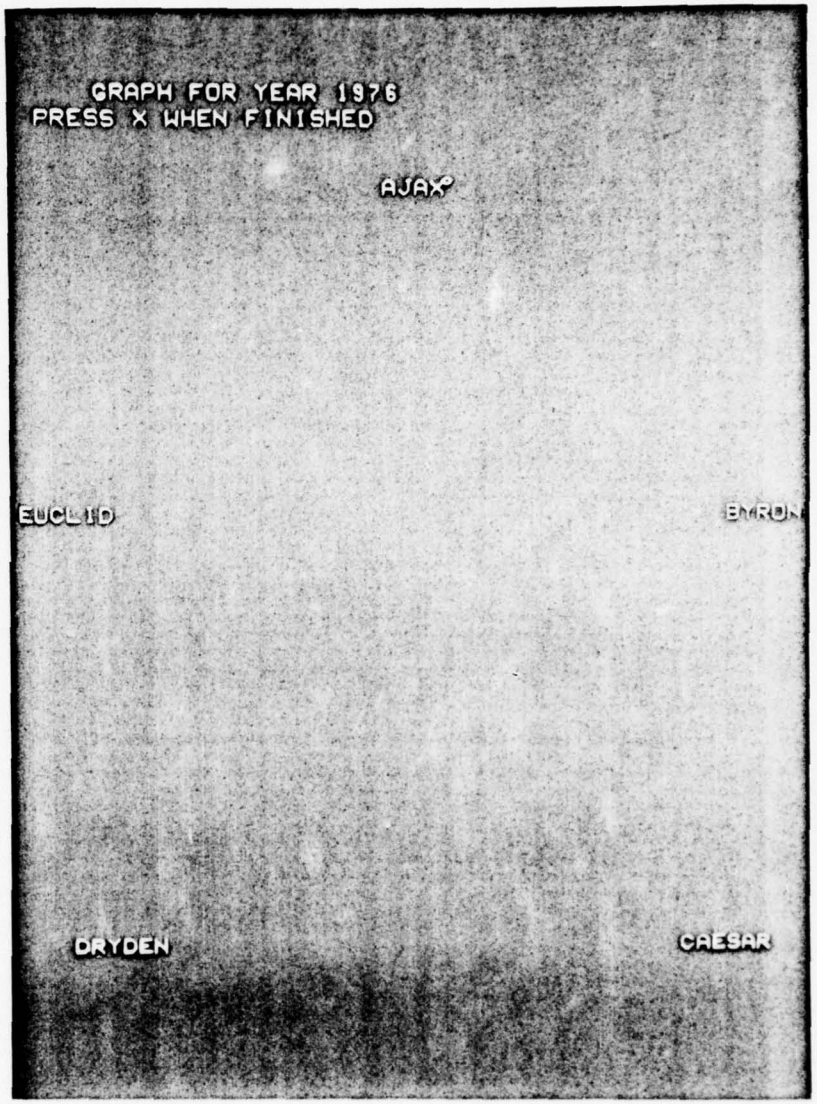
BEST AVAILABLE COPY



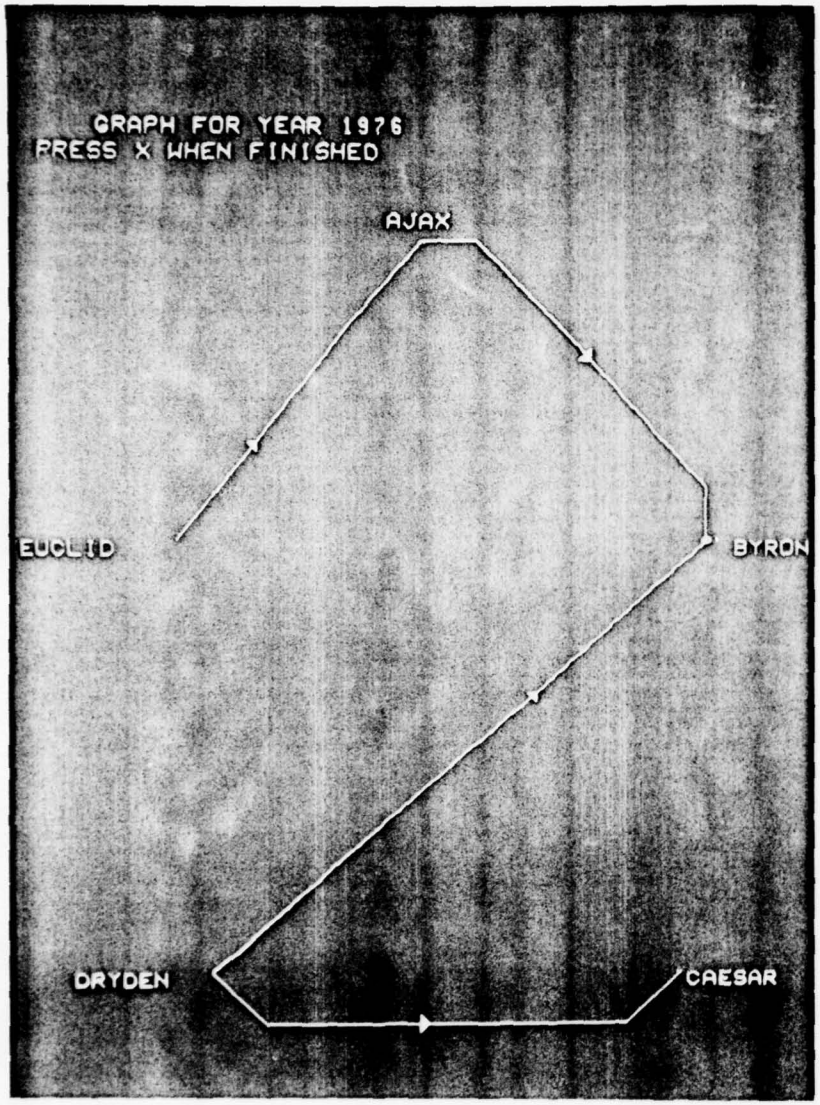
6(34) This was the subject's response for the first of the six years (1976). NB. He was required to recall his prediction for 1981 in addition to the lists he learned. As usual confidence is estimated for each year but no repetitions are requested.



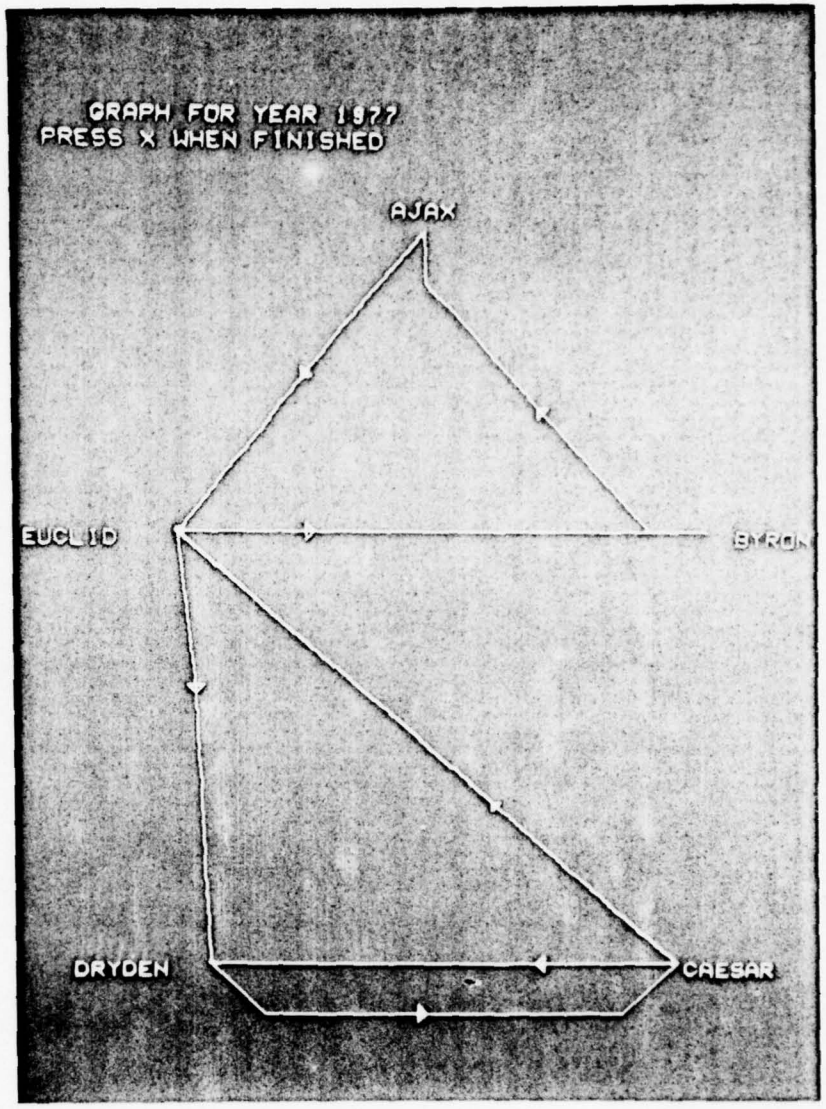
6(35) Subject can choose to recall graphs in the form in which he first saw them or as maps showing boundaries. In this case he chose the original abstract form.



6(36) This shows the spy names arranged as in the earlier abstract form. At this point the program is waiting for the subject to type pairs of initials to show the connections.

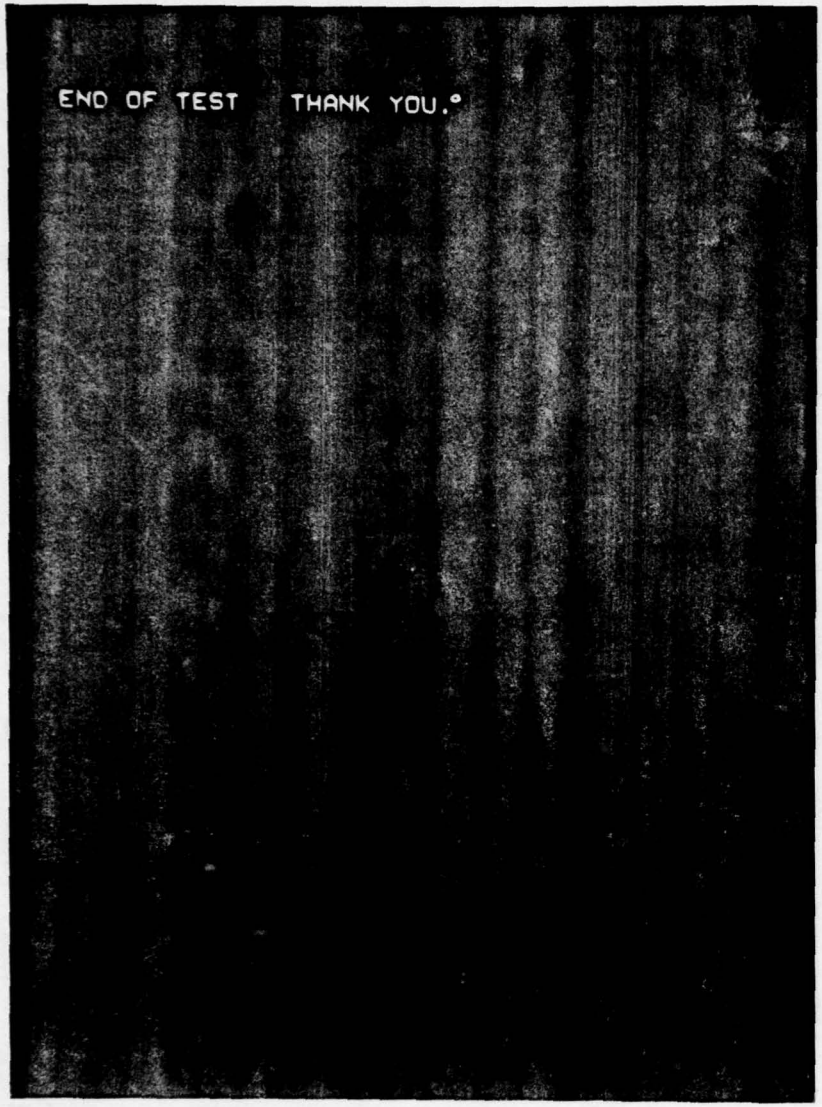


BEST AVAILABLE COPY



6(37) Subject has typed four pairs of initials so far. As before lines and arrows are displayed automatically with arrow direction again in accordance with the subjects distinction of sender/receiver (sender first).

6(38) Subject has finished graph for 1976. Confidence has been estimated and he has now finished his recall of the graph for 1977. NB. As with list recall no repetition is required.



6(39) Graphs have been recalled for all six years (including prediction year 1981). "End of Test" message is shown.

BEST AVAILABLE COPY

(a) ANY AGENT CAN TRANSMIT MESSAGES TO (ONE OR MORE) OTHER AGENTS (EITHER IN THE SAME COUNTRY OR IN A DIFFERENT COUNTRY).

(b) ANY AGENT CAN RECIEVE MESSAGES FROM (ONE OR MORE) OTHER AGENTS (EITHER IN THE SAME COUNTRY OR A DIFFERENT COUNTRY)

(c) ONE AGENT RECEIVES MESSAGES AND PASSES THEM ON WITHOUT DELAY

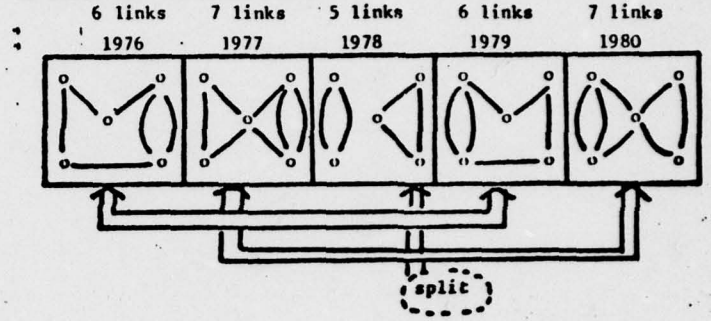
(d) TWO AGENTS CAN EITHER ORIGINATE OR PASS ON MESSAGES

(e) TWO AGENTS ASSIMILATE RECEIVED MESSAGES BEFORE THEY ARE ABLE TO ACT AS MESSAGE TRANSMITTERS

(f) THERE ARE 5 AGENTS IN ALL AND THEY ARE IN 3 COUNTRIES (RURITANIA, TRANSLYVANIA, AND OLYMPIA).

6(40) This and the following frames show some typical informationas obtained from the information menue in the form of slides. This slide would be obtained on pressing option (1) of 6(15) followed by (1) of 6(16)

IF DIRECTIONS ARE DISREGARDED THE NETWORK OF 1976 IS THE MIRROR IMAGE OF THE NETWORK OF 1979: SIMILARLY THE NETWORK OF 1977 IS THE MIRROR IMAGE OF THE NETWORK OF 1980. IN 1978 THE NETWORK IS SPLIT INTO DISTINCT PARTS.



6(41) Information displayed as a result of option (1) of 6(15) followed by (3) of 6(16)

1977

DRYDEN → EUCLID
EUCLID → BYRON
BYRON → AJAX
DRYDEN → CAESAR
BYRON → AJAX
AJAX → EUCLID
EUCLID → CAESAR
CAESAR → DRYDEN

6(44) Result of (4) of 6(15) - any list or graph
(3) of 6(21) - lists
(2) of 6(22) - which year
Note that countries <u>not</u> indicated as they were in 6(6)

THE RECORDED TRANSACTIONS WITHIN RURITANIA AND CROSSING THE RURITANIC BORDER (INTO OR OUT OF) ARE AS FOLLOWS (FROM SAMPLES OF 8 CONSECUTIVE TRANSACTIONS).

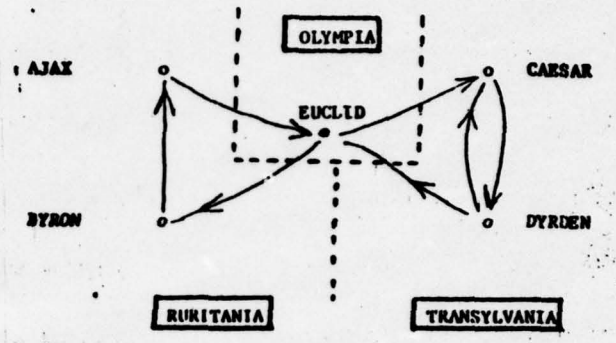
1976	1977	1978	1979	1980
Within	Into	Within	Within	Within
Into	Within	Within	Out	Out
Out	Within	Within	Into	Into
Out	Out		Into	Within
			Within	
			Within	

6(45) Result of (5) of 6(15) - any country
(3) of 6(23) - Ruritania
(3) of 6(24) - possible messages

IN THE FOLLOWING YEARS AJAX CAN COMMUNICATE
IN ONE OR BOTH DIRECTIONS WITH

1976	1977	1978	1979	1980
Byron	Byron	Byron	Byron	Byron
Euclid	Euclid		Euclid	Euclid

6(42) Result of option (2) of 6(15) followed by
(1) of 6(17)
(3) of 6(18)



1977

6(43) Result of option (3) of 6(15) -any year
(2) of 6(19) -which year
(1) of 6(20) -the map

Appendix 1 Mathematical Basis for Design 1 (Fig 1)

Stoichiometric Equation

$$N_A\ A + N_B\ B \rightleftharpoons N_C\ C + N_D\ D$$

Coefficients N_A, N_B, N_C, N_D, set (using rotary switches) to values 0, 1 or 2.

Integrators:

One integrator for each term in stoichiometric equation

$$V_{out} = \frac{-1}{RC} \int_0^t V_{in}\,dt + V_{t=0}$$

$$\text{net rate } \lambda_{net} = \frac{-1}{N_A} \frac{d[A]}{dt} = \frac{-1}{N_B} \frac{d[B]}{dt} = \frac{1}{N_C} \frac{d[C]}{dt}$$

$$= \frac{1}{N_D} \frac{d[D]}{dt}$$

For reactant A, for example,

$$V_{in} = \frac{d[A]}{dt} = \lambda_{net} \times N_A$$

$V_{t=0}$ = initial concentration of A (set with integrator in reset mode)

$\frac{1}{RC}$ = scaling factor (R = 1 MΩ , C = 4.7 μ F)

$V_{out} = [A]$ (concentration of A at time t)

Rate Expression Generators

Eg . Forward reaction : -

$$\lambda_F = K_F [A]^{N_A} [B]^{N_B}$$

λ_F = forward rate

K_F = forward rate constant - computed as a function of temp.

N_A, N_B = stoichiometric coefficients (switch settings)

λ_F, K_F, A, B — voltages in range - 10v - +10v.

Arrhenius Function Generator

Forward reaction

$$\text{Log } K_F = \text{Log } A_F - \frac{E_F^*}{2.3\ RT}$$

$$K_F = \text{antilog} \left[\text{Log } A_F - \frac{E_F^*}{2.3\ RT} \right]$$

K_F = forward rate constant

Log A_F = forward reaction frequency factor

E_F^* = forward reaction activation energy

T = temperature

K_F - voltage in range 0 - 10v

Log $\left.\begin{matrix} A_F \\ E^*_F \end{matrix}\right\}$ - parameters set by potentiometers

R - Fixed parameters (gas constant)

T - temperature (^oK) , voltage, with 1 volt change representing 100° K change in temperature.

Appendix 2- Mathematical Basis for Design 2 (Fig 2)

The main difference between Design 1 and Design 2 arises because the differential equation governing the relationship between reaction rate and concentration is formulated differently.

This leads to an implementation using a single integrator and four summing units in place of the four integrators used in the first design.

The second design has advantages in terms of cost and ease of setting up but is not so easily interconnected with other units to simulate a chain of reactions.

Rate Expression:

Let x = normalised decrease in concentration of A, B, in time t.
and
- x = normalised increase in concentration of C, D, in time t.

Actual decrease in $A = N_A x$
$B = N_B x$
$C = -N_C x$
$D = -N_D x$

$$\text{Net rate } \lambda_{net} = \frac{-1}{N_A}\frac{d[A]}{dt} = \frac{-1}{N_B}\frac{d[B]}{dt}$$

$$= \frac{1}{N_C}\frac{d[C]}{dt} = \frac{1}{N_D}\frac{d[D]}{dt}$$

$$\text{For A } \lambda_{net} = \frac{-1}{N_A}\frac{d[A]}{dt}$$

$$= \frac{-1}{N_A}\frac{d\left([A_o] - N_A x\right)}{dt}$$

A_o = initial concentration of A.

therefore $\lambda_{net} = \frac{dx}{dt}$.

Integrating λ_{net} therefore gives x as a function of time, summing $N_A x$, $N_B x$, $- N_C x$, $- N_D x$ with voltages set to represent $[A]_o$, $[B]_o$, $[C]_o$, $[D]_o$, gives instantaneous values of concentration

Appendix 3

(a) Formulation of rate equations in terms of net rate.

Stoichiometric equation:

$$N_A A + N_B B \rightleftharpoons N_C C + N_D D$$

Forward Rate expression:

$$\lambda_F = K_F [A]^{N_A} [B]^{N_B}$$

λ_F = Forward Rate

K_F = Forward rate constant

N_A, N_B = stoichiometric coefficients.

Reverse Rate Expression:

$$\lambda_R = K_R [C]^{NC} [D]^{ND}$$

λ_R = Reverse rate

K_R = Reverse rate constant

N_C, N_D = stoichiometric coefficients.

Net Rate

$$\lambda_{net} = \lambda_F - \lambda_R$$

$$\lambda_{net} = \frac{-1}{N_A}\frac{d[A]}{dt} = \frac{-1}{N_A}\frac{d[B]}{dt}$$

$$= \frac{1}{N_C}\frac{d[C]}{dt} = \frac{1}{N_D}\frac{d[D]}{dt}$$

(b) Equilibrium constant and ΔH (enthalpy change)

At equilibrium:-

Forward rate = reverse rate

$$K_F [A]^{NA} [B]^{NA} = K_R [C]^{NC} [D]^{ND}$$

$$\frac{K_F}{K_R} = \frac{[C]^{NC} [D]^{ND}}{[A]^{NA} [B]^{NB}}$$

This agrees with the "equilibrium law" which states that for a reaction with the stoichiometry:

$$N_A A + N_B B \rightleftharpoons N_C C + N_D D$$

The equilibrium constant, $K_{eq} = \frac{[C]^{NC} [D]^{ND}}{[A]^{NA} [B]^{NB}}$

Note: the simulator will not produce the expected values of equilibrium constant unless the values of the exponents in the rate expressions are equal to the corresponding stoichiometric coefficients. More complex forms of rate expression are best simulated by interconnecting 2 or more simulators to produce a "non-elementary" reaction.

Variation of Equilibrium Constant with Temperature

$$K_{eq} = \frac{K_F}{K_R} = \frac{A_F \, e^{\frac{-E_F^*}{R\,T}}}{A_R \, e^{\frac{-E_R^*}{RT}}}$$

(Arrhenius functions for forward and reverse rate constants)

therefore:

$$\text{Ln } K_{eq} = \text{Ln} \frac{A_F}{A_R} - \frac{(E_F^* - E_R^*)}{RT}$$

But $E_F^* - E_R^* = \Delta H$ enthalpy change for the reaction

therefore:

$$\text{Ln } K_{eq} = \text{Ln} \frac{A_F}{A_R} - \frac{\Delta H}{RT}$$

Comparing this with the expression relating equilibrium constant and the free energy ΔG:

$$G = R\,T\,\mathrm{Ln}\,K_{eq}$$

and substituting

$$G = \Delta H - T\,\Delta S \qquad (\Delta S = \text{entropy change})$$

gives $$\mathrm{Ln}\,K_{eq} = \frac{\Delta S}{R} - \frac{\Delta H}{RT}$$

The simulator parameters A_F and A_{rR} can therefore be interpreted in terms of the entropy change for a reaction if required.

Graphs of Log K_{eq} vs. $(T)^{-1}$ should be linear with the sign of the slope depending on the sign of ΔH.

```
LIST

10 PRINT "A0,K (VOLTS)"
20 INPUT A0,K
30 PRINT "K (VOLTS) =";K
40 PRINT "IST ORDER REACTION A =B+C"
50 PRINT "T","A (VOLTS)","B AND C (VOLTS)","LN A"
60 FOR I = 1 TO 18
70 LET A = A0 - (I-1)*0.5
80 LET B = (A0 -A)
90 LET T = 4.7*20*(LOG(A0) - LOG(A))/K
100 PRINT T,A,B,LOG(A)
110 NEXT I
120 END

*RUN

A0,K (VOLTS)
?10,1
K (VOLTS) = 1
IST ORDER REACTION A =B+C
T             A (VOLTS)      B AND C (VOLTS)LN A
 0             10             0              2.30258
 4.82155       9.5            0.5            2.25129
 9.90389       9              1              2.19722
 15.2768       8.5            1.5            2.14007
 20.9755       8              2              2.07944
 27.0421       7.5            2.5            2.0149
 33.5274       7              3              1.94591
 40.4936       6.5            3.5            1.8718
 48.0176       6              4              1.79176
 56.1967       5.5            4.5            1.70475
 65.1558       5              5              1.60944
 75.0597       4.5            5.5            1.50408
 86.1313       4              6              1.38629
 98.6833       3.5            6.5            1.25276
 113.173       3              7              1.09861
 130.312       2.5            7.5            0.916291
               2              8              0.693147
```

130.312	2.5	7.5	[illegible]
151.287	2	8	0.693147
178.329	1.5	8.5	0.405465

2

```
*RUN

A0,K (VOLTS)
?10,0.5
K (VOLTS) = 0.5
IST ORDER REACTION A =B+C
```

T	A (VOLTS)	B AND C (VOLTS)	LN A
0	10	0	2.30258
9.64311	9.5	0.5	2.25129
19.8078	9	1	2.19722
30.5535	8.5	1.5	2.14007
41.951	8	2	2.07944
54.0842	7.5	2.5	2.0149
67.0548	7	3	1.94591
80.9872	6.5	3.5	1.8718
96.0352	6	4	1.79176
112.393	5.5	4.5	1.70475
130.312	5	5	1.60944
150.119	4.5	5.5	1.50408
172.263	4	6	1.38629
197.367	3.5	6.5	1.25276
226.347	3	7	1.09861
260.623	2.5	7.5	0.916291
302.574	2	8	0.693147
356.659	1.5	8.5	0.405465

Appendix 4 - BASIC computer programs for scaling and performance evaluation
(a) 1st order reaction

cont/..

```
LIST

10 INPUT A,B,T1
20 PRINT "A =";A
30 PRINT "B =";B
40 PRINT "TEMP OFFSET =";T1
50 PRINT "T","DOP","ALIP","K"
60 FOR I=1TO 10
70 LET T=T1 +0.1*I
80 LET X =10*B/T
90 LET Y=3+A-X
100LET K = 10↑Y
110 PRINT T,X,Y,K
120 NEXT I
130 END

*RUN

?13.93,12.69,7
A = 13.93
B = 12.69
TEMP OFFSET = 7
T              DOP            ALIP            K
 7.1            17.8732        -0.943239       0.113962
 7.2            17.625         -0.695          0.201837
 7.3            17.3836        -0.453562       0.351915
 7.4            17.1486        -0.218649       0.604437
 7.5            16.92           1.00002E-02    1.02329
 7.6            16.6974         0.232632       1.70357
 7.7            16.4805         0.449482       2.81502
 7.8            16.2692         0.66077        4.579
 7.9            16.0633         0.866709       7.35713
 8              15.8625         1.0675         11.6816

*RUN

?13.93,12.0,7
A = 13.93
B = 12
TEMP OFFSET = 7
T              DOP            ALIP            K
 7.1            16.9014         2.85912E-02    1.06805
 7.2            16.6667         0.263332       1.83372
 7.3            16.4384         0.491644       3.10201
 7.4            16.2162         0.713783       5.17349
 7.5            16              0.93           8.51138
 7.6            15.7895         1.14053        13.8206
 7.7            15.5844         1.34558        22.1607
 7.8            15.3846         1.54538        35.1062
 7.9            15.1899         1.74013        54.97
 8              15              1.93           85.1139

*
```

Appendix 4 cont/..

(b) Arrhenius Function Generator

Appendix 5

Program Listing for Spy Ring History Test

```
PAGE  0001

0001                        NAM   MAIN,PRIN,BUFAD,WATE1,ERAS,ASAVE,XSAVE
0002                        NAM   BG2
0003                        NAM   BEGIN,E,R,OTL,OTT
0004                        NAM   ODEC,XS
0005                        NAM   CRLF
0006                        NAM   BEIN,CEIN
0007                        NAM   GO2
0008        0004            MACH  4
0009  0100                  REL   :0100
0010  0100          GRAX    REF
0011  0101          TEST1   REF
0012  0102          TES21   REF
0013  0103  0000    COUNT   DATA  0
0014  0104  0000    ASAVE   DATA  0
0015  0105  0000    XSAVE   DATA  0
0016  0106  0000    STATUS  DATA  0
0017  0107  0000    TINC    DATA  0
0018  0108  0000    TIMUP   DATA  0
0019  0109  F27A    START   JMP   BEGIN
0020  010A  0800    OTT     ENT
0021  010B  9A0D            STA   TMP
0022  010C  D20D            CMS   TMPEN
0023  010D  0000            NOP
0024  010E  F201            JMP   OTT2
0025  010F  F30B            RTN   OTL
0026  0110  B207    OTT2    LDA   TCN
0027  0111  00D0            DAR
0028  0112  3141            JAN   $-1
0029  0113  B205            LDA   TMP
0030  0114  6C38            OTA   070
0031  0115  4939            SEN   071
0032  0116  F601            JMP   $-1
0033  0117  F70D    OTXX    RTN   OTT
0034  0118  1250    TCN     DATA  :1250
0035  0119  0000    TMP     DATA  0
0036  011A  00C0    TMPEN   DATA  '@'
0037  011B  0800    OTL     ENT
0038  011C  E247            LDX   BUFAD
0039  011D  0000            NOP
0040  011E  B400    OT1     LDA   @0
0041  011F  9A09            STA   AOTL
0042  0120  13D7            LRA   8
0043  0121  FE17            JST   OTT
0044  0122  B206            LDA   AOTL
0045  0123  1357            LLA   8
0046  0124  13D7            LRA   8
0047  0125  FE1B            JST   OTT
0048  0126  0128            IXR
0049  0127  F609            JMP   OT1
0050  0128  C000    CAI     CAI   0
0051  0129  0000    AOTL    DATA  0
0052  012A  0800    ODEC    ENT
0053  012B  EA29            STX   S
```

61a

```
PAGE  0002

0054  012C  C4AB            LXP   '+'
0055  012D  3082            JAP   $+3
0056  012E  0310            NAR
0057  012F  C202            AXI   2
0058  0130  9A25            STA   V
0059  0131  0030            TXA
0060  0132  E221            LDX   XS
0061  0133  2801            JXZ   ODC
0062  0134  FE2A            JST   OTT
0063  0135  B223    ODC     LDA   STRT
0064  0136  9A21            STA   PTR
0065  0137  C705            LAM   5
0066  0138  9A1E            STA   T1
0067  0139  B21C    O1      LDA   V
0068  013A  C4AF            LXP   :AF
0069  013B  931C            SUB   *PTR
0070  013C  0128            IXR
0071  013D  30C2            JAP   $-2
0072  013E  8B19            ADD   *PTR
0073  013F  9A16            STA   V
0074  0140  0030            TXA
0075  0141  0000    EXC     NOP
0076  0142  C0B0            CAI   :B0
0077  0143  F201            JMP   ADEC      A=0
0078  0144  F201            JMP   CDEC      A>0
0079  0145  F205    ADEC    JMP   BIM
0080  0146  9A0C    CDEC    STA   OTEM
0081  0147  B20A            LDA   JUM
0082  0148  9E07            STA   EXC
0083  0149  B209            LDA   OTEM
0084  014A  FE40            JST   OTT
0085  014B  DA0C    BIM     IMS   PTR
0086  014C  DA0A            IMS   T1
0087  014D  F614            JMP   O1
0088  014E  E206            LDX   S
0089  014F  0110            ZAR
0090  0150  9E0F            STA   EXC
0091  0151  F727            RTN   ODEC
0092  0152  F208    JUM     DATA  :F208
0093  0153  0000    OTEM    DATA  0
0094  0154  0000    XS      DATA  0
0095  0155  0800    S       HLT
0096  0156  0800    V       HLT
0097  0157  0800    T1      HLT
0098  0158  0800    PTR     HLT
0099  0159  015A    STRT    DATA  TBL
0100  015A  2710    TBL     DATA  10000,1000,100
      015B  03E8
      015C  0064
0101  015D  000A            DATA  10,1
      015E  0001
0102  015F  0800    MAIN    ENT
0103  0160  C6C0            LAP   '@'
```

61b

```
PAGE  0003

0104  0161  0F00          SWM
0105  0162  FE47          JST     OTL
0106  0163  F704          RTN     MAIN
0107  0164  0000  BUFAD   DATA    0
0108  0165  0001  G       DATA    1
0109  0166  0000  R       DATA    0
0110  0167  0000  T       DATA    0
0111  0168  0001  I       DATA    1
0112  0169  0001  J       DATA    1
0113  016A  0001  P       DATA    1
0114  016B  0000  PB      DATA    0
0115  016C  0001  E       DATA    1
0116  016D  0000  M       DATA    0
0117  016E  0800  ERAS    ENT
0118  016F  9E6B          STA     ASAVE
0119  0170  EE6B          STX     XSAVE
0120  0171  C60C          LAP     12
0121  0172  FA0A          JST     PRIN
0122  0173  E208          LDX     NULS
0123  0174  0110          ZAR
0124  0175  FA07  B1      JST     PRIN
0125  0176  00A8          DXR
0126  0177  3842          JXN     B1
0127  0178  B674          LDA     ASAVE
0128  0179  B675          LDA     ASAVE
0129  017A  E675          LDX     XSAVE
0130  017B  F70D          RTN     ERAS
0131  017C  0060  NULS    DATA    96
0132  017D  0800  PRIN    ENT
0133  017E  6D3B          WRA     :3B
0134  017F  F702          RTN     PRIN
0135  0180  0000  TEXT    DATA    0
0136  0181  07B7  BASE    DATA    1975
0137  0182  0005  FV      DATA    5
0138  0183  0800  BEIN    ENT
0139  0184  FE16  BEGIN   JST     ERAS
0140  0185  C606          LAP     6
0141  0186  D61A          CMS     E
0142  0187  0000          NOP
0143  0188  F201          JMP     BG1
0144  0189  F787          JMP     *TES21
0145  018A  0000  BG1     NOP
0146  018B  FA01          JST     BG2
0147  018C  F20B          JMP     BG3
0148  018D  0800  BG2     ENT
0149  018E  B60D          LDA     BASE
0150  018F  8E23          ADD     E
0151  0190  9E23          STA     M
0152  0191  B264          LDA     AFB
0153  0192  9E2E          STA     BUFAD
0154  0193  FE34          JST     MAIN
0155  0194  B627          LDA     M
0156  0195  0F00          SWM
```

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```
PAGE  0004

0157  0196  FE6C          JST     ODEC
0158  0197  F70A          RTN     BG2
0159  0198  B62C  BG3     LDA     E       GET EPOK
0160  0199  00D0          DAR             DIP E
0161  019A  3103          JAN     TW      EPOC 1?
0162  019B  B264          LDA     CFB     E=1
0163  019C  9E38          STA     BUFAD
0164  019D  F211          JMP     GO
0165  019E  00D0  TW      DAR
0166  019F  3103          JAN     TH
0167  01A0  B2F8          LDA     DFB     E=2
0168  01A1  9E3D          STA     BUFAD
0169  01A2  F20C          JMP     GO
0170  01A3  00D0  TH      DAR
0171  01A4  3103          JAN     FR
0172  01A5  B100          LDA     EFB
                0332
0173  01A6  9E42          STA     BUFAD
0174  01A7  F207          JMP     GO      E=3
0175  01A8  00D0  FR      DAR
0176  01A9  3103          JAN     FIV
0177  01AA  B100          LDA     FFB     E=4
                03CB
0178  01AB  9E47          STA     BUFAD
0179  01AC  F202          JMP     GO
0180  01AD  B100  FIV     LDA     GFB
                0464
0181  01AE  9E4A          STA     BUFAD
0182  01AF  FE50  GO      JST     MAIN
0183  01B0  B231          LDA     DT1     PUT TIM IN TINC
0184  01B1  FA05          JST     WATE1
0185  01B2  FA0E          JST     GO2
0186  01B3  B64D          LDA     R
0187  01B4  C0FF          CAI     :FF
0188  01B5  F732          RTN     BEIN
0189  01B6  F213          JMP     GRAF1
0190  01B7  0800  WATE1   ENT
0191  01B8  9EB1          STA     TINC
0192  01B9  B206          LDA     TENTH
0193  01BA  00D0          DAR
0194  01BB  3141          JAN     $-1
0195  01BC  B6B5          LDA     TINC
0196  01BD  00D0          DAR
0197  01BE  3146          JAN     $-6
0198  01BF  F708          RTN     WATE1
0199  01C0  7C38  TENTH   DATA    :7C38
0200  01C1  0800  GO2     ENT
0201  01C2  B100          LDA     HFB     EXPOS FINIS
                04FD
0202  01C3  9E5F          STA     BUFAD
0203  01C4  FE65          JST     MAIN
0204  01C5  B21D          LDA     DT2
0205  01C6  9EBF          STA     TINC
```

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```
0206 01C7 FE10        JST   WATE1
0207 01C8 FE5A        JST   ERAS
0208 01C9 F708        RTN   G02        TIME UP ERASR GO BAC
0209 01CA B665  GRAF1 LDA   G          CHEK G IF
0210 01CB 211A        JAZ   TEST       0 THEN NO GRAPH SO
0211 01CC F201        JMP   GRAF2
0212 01CD 0800  CEIN  ENT
0213 01CE B100  GRAF2 LDA   IFB        START TEST
     01CF 050D
0214 01CF 9E6B        STA   BUFAD
0215 01D0 FE71        JST   MAIN       GRAPH FOR YEAR M
0216 01D1 B650        LDA   BASE
0217 01D2 8E66        ADD   E
0218 01D3 9E66        STA   M
0219 01D4 B667        LDA   M
0220 01D5 FEAB        JST   ODEC
0221 01D6 B670        LDA   R
0222 01D7 C0FD        CAI   :FD
0223 01D8 F70B        RTN   CEIN
0224 01D9 B66D        LDA   E
0225 01DA FFDA  G03   JST   *GRAX
0226 01DB B206        LDA   DTI        TIME EXPOSURE
0227 01DC FE25        JST   WATE1
0228 01DD FE1C        JST   G02        'FINISHING'
0229 01DE B678        LDA   R
0230 01DF C0FF        CAI   :FF
0231 01E0 F713        RTN   CEIN
0232 01E1 F204        JMP   TEST
0233 01E2 03E8  DTI   DATA  1000
0234 01E3 001E  DT2   DATA  30
0235 01E4 0070  DT3   DATA  :70
0236 01E5 00C0  DT4   DATA  :C0
0237 01E6 B100  TEST  LDA   OFB        TEST START MESS.
     01E7 0518
0238 01E7 9E83        STA   BUFAD
0239 01E8 FE89        JST   MAIN
0240 01E9 B606        LDA   DT2
0241 01EA FE33        JST   WATE1
0242 01EB FE7D        JST   ERAS       CLEAR SCREEN
0243 01EC FE5F  TESTX JST   BG2
0244 01ED FA02        JST   CRLF
0245 01EE FA01        JST   CRLF
0246 01EF F7EE        JMP   *TEST1
0247 01F0 0800  CRLF  ENT
0248 01F1 C60A        LAP   :0A
0249 01F2 6D3B        WRA   :3B
0250 01F3 C60D        LAP   :0D
0251 01F4 6D3B        WRA   :3B
0252 01F5 F705        RTN   CRLF
0253 01F6 01F7  AFB   DATA  BFA
0254 01F7 A0A0  BFA   TEXT  '   LIST FOR YEAR @'
     01F8 A0CC
     01F9 C9D3
```

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```
0253 AFB DATA BFA
0254 BFA TEXT '   LIST FOR YEAR @'
0255 CFB DATA BFC
0256 BFC DATA 10,13
0257  TEXT '   BYRON  (R) SENDS TO AJAX   (R)'
0258  DATA 10,13
0259  TEXT '   DRYDEN (T) SENDS TO CAESAR (T)'
0260  DATA 10,13
0261  TEXT '   DRYDEN (T) SENDS TO BYRON  (R)'
0262  DATA 10,13
0263  TEXT '   BYRON  (R) SENDS TO AJAX   (R)'
0264  DATA 10,13
0265  TEXT '   AJAX   (R) SENDS TO EUCLID (O)'
0266  DATA 10,13
0267  TEXT '   EUCLID (O) SENDS TO CAESAR (T)'
0268  DATA 10,13
0269  TEXT '   CAESAR (T) SENDS TO DRYDEN (T)'
0270  DATA 10,13
0271  TEXT '   DRYDEN (T) SENDS TO CAESAR (T)@'
0272 DFB DATA BFD
0273 BFD DATA 10,13
0274  TEXT '   DRYDEN (T) SENDS TO EUCLID (O)'
0275  DATA 10,13
0276  TEXT '   EUCLID (O) SENDS TO BYRON  (R)'
0277  DATA 10,13
0278  TEXT '   BYRON  (R) SENDS TO AJAX   (R)'
0279  DATA 10,13
0280  TEXT '   DRYDEN (T) SENDS TO CAESAR (T)'
0281  DATA 10,13
0282  TEXT '   BYRON  (R) SENDS TO AJAX   (R)'
0283  DATA 10,13
0284  TEXT '   AJAX   (R) SENDS TO EUCLID (O)'
0285  DATA 10,13
0286  TEXT '   EUCLID (O) SENDS TO CAESAR (T)'
0287  DATA 10,13
0288  TEXT '   CAESAR (T) SENDS TO DRYDEN (T)@'
0289 EFB DATA BFE
0290 BFE DATA 10,13
0291  TEXT '   DRYDEN (T) SENDS TO EUCLID (O)'
0292  DATA 10,13
0293  TEXT '   EUCLID (O) SENDS TO CAESAR (T)'
0294  DATA 10,13
0295  TEXT '   BYRON  (R) SENDS TO AJAX   (R)'
0296  DATA 10,13
0297  TEXT '   DRYDEN (T) SENDS TO EUCLID (O)'
0298  DATA 10,13
0299  TEXT '   EUCLID (O) SENDS TO CAESAR (T)'
0300  DATA 10,13
0301  TEXT '   BYRON  (R) SENDS TO AJAX   (R)'
0302  DATA 10,13
0303  TEXT '   CAESAR (T) SENDS TO DRYDEN (T)'
0304  DATA 10,13
0305  TEXT '   AJAX   (R) SENDS TO BYRON  (R)@'
```

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```
0306 FFB DATA BFF
0307 BFF DATA 10,13
0308  TEXT '   DRYDEN (T) SENDS TO CAESAR (T)'
0309  DATA 10,13
0310  TEXT '   BYRON  (R) SENDS TO AJAX   (R)'
0311  DATA 10,13
0312  TEXT '   BYRON  (R) SENDS TO DRYDEN (T)'
0313  DATA 10,13
0314  TEXT '   DRYDEN (T) SENDS TO CAESAR (T)'
0315  DATA 10,13
0316  TEXT '   CAESAR (T) SENDS TO EUCLID (O)'
0317  DATA 10,13
0318  TEXT '   EUCLID (O) SENDS TO AJAX   (R)'
0319  DATA 10,13
0320  TEXT '   AJAX   (R) SENDS TO BYRON  (R)'
0321  DATA 10,13
0322  TEXT '   BYRON  (R) SENDS TO AJAX   (R)@'
0323 GFB DATA BFG
0324 BFG DATA 10,13
0325  TEXT '   DRYDEN (T) SENDS TO CAESAR (T)'
0326  DATA 10,13
0327  TEXT '   BYRON  (R) SENDS TO AJAX   (R)'
0328  DATA 10,13
0329  TEXT '   DRYDEN (T) SENDS TO CAESAR (T)'
0330  DATA 10,13
0331  TEXT '   BYRON  (R) SENDS TO EUCLID (O)'
0332  DATA 10,13
0333  TEXT '   EUCLID (O) SENDS TO AJAX   (R)'
0334  DATA 10,13
0335  TEXT '   AJAX   (R) SENDS TO BYRON  (R)'
0336  DATA 10,13
0337  TEXT '   DRYDEN (T) SENDS TO CAESAR (T)'
0338  DATA 10,13
0339  TEXT '   CAESAR (T) SENDS TO EUCLID (O)@'
0340 HFB DATA BFH
0341 BFH DATA 10,13
0342  TEXT '       EXPOSURE FINISHING@'
0343 IFB DATA BFI
0344 BFI TEXT '   GRAPH FOR YEAR @'
0345 OFB DATA BFO
0346 BFO TEXT ' START OF TEST; RESPOND IN SHORTHAND'
0347  DATA '@'
0348 PFB DATA BFP
0349 BFP DATA 0
0350  END

?
```

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PAGE 0001

```
0001                        NAM   GRAX,STPT,LVCT,NAMZ,LINZ
0002                        NAM   GRAS
0003        0004            MACH  4
0004  0000                  REL   0
0005  0000          XGRA1   REF
0006  0001          YGRA1   REF
0007  0002          MAIN    REF
0008  0003          PRIN    REF
0009  0004          BUFAD   REF
0010  0005  0800    GRAX    ENT
0011  0006  9A03            STA   GRAS      STORE EPOCH NO.
0012  0007  FA03            JST   NAMZ
0013  0008  FA96            JST   LINZ
0014  0009  F704            RTN   GRAX
0015  000A  0000    GRAS    DATA  0
0016  000B  0800    NAMZ    ENT
0017  000C  C61D            LAP   035       SET PNT MOD
0018  000D  6D3B            WRA   :3B
0019  000E  B240            LDA   CNT
0020  000F  9A40            STA   CNTR
0021  0010  B232            LDA   X1
0022  0011  9A3F            STA   XPTR
0023  0012  B236            LDA   Y1
0024  0013  9A3E            STA   YPTR
0025  0014  B33C    I1      LDA   *XPTR
0026  0015  E33C            LDX   *YPTR
0027  0016  FA3D            JST   STPT
0028  0017  C61C            LAP   034       SYMBOL MOD
0029  0018  6D3B            WRA   :3B
0030  0019  B239            LDA   XCN
0031  001A  3106            JAN   AJA
0032  001B  B26C            LDA   GFB       AJAX
0033  001C  9F18            STA   *BUFAD
0034  001D  FF1B            JST   *MAIN
0035  001E  C604            LAP   4
0036  001F  9A33            STA   XCN
0037  0020  F218            JMP   WRIT1
0038  0021  00D0    AJA     DAR
0039  0022  3104            JAN   BYRO
0040  0023  B268            LDA   RFB       BYRON
0041  0024  9F20            STA   *BUFAD
0042  0025  FF23            JST   *MAIN
0043  0026  F20F            JMP   WRIT
0044  0027  00D0    BYRO    DAR
0045  0028  3104            JAN   CAES
0046  0029  B266            LDA   SFB       CAESAR
0047  002A  9F26            STA   *BUFAD
0048  002B  FF29            JST   *MAIN
0049  002C  F209            JMP   WRIT
0050  002D  00D0    CAES    DAR
0051  002E  3104            JAN   DRYD
0052  002F  B265            LDA   TFB       DRYDEN
0053  0030  9F2C            STA   *BUFAD
```

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```
PAGE  0002

0054  0031  FF2F        JST    *MAIN
0055  0032  F203        JMP    WRIT
0056  0033  B266  DRYD  LDA    UFB       EUCLID
0057  0034  9F30        STA    *BUFAD
0058  0035  FF33        JST    *MAIN
0059  0036  B21C  WRIT  LDA    XCN
0060  0037  00D0        DAR
0061  0038  9A1A        STA    XCN
0062  0039  B216  WRIT1 LDA    CNTR
0063  003A  00D0        DAR
0064  003B  9A14        STA    CNTR
0065  003C  2105        JAZ    I2
0066  003D  DA13        IMS    XPTR
0067  003E  DA13        IMS    YPTR
0068  003F  C61D        LAP    :1D
0069  0040  6D3B        WRA    :3B
0070  0041  F62D        JMP    I1
0071  0042  F737  I2    RTN    NAMZ
0072  0043  0044  X1    DATA   X
0073  0044  FE93  X     DATA   -365,-325,235,275,-30
      0045  FEBB
      0046  00EB
      0047  0113
      0048  FFE2
0074  0049  004A  Y1    DATA   Y
0075  004A  0032  Y     DATA   50,-350,-350,50,350
      004B  FEA2
      004C  FEA2
      004D  0032
      004E  015E
0076  004F  0005  CNT   DATA   5
0077  0050  0000  CNTR  DATA   0
0078  0051  0000  XPTR  DATA   0
0079  0052  0000  YPTR  DATA   0
0080  0053  0004  XCN   DATA   4
0081  0054  0800  STPT  ENT
0082  0055  FA0F        JST    STAMD
0083  0056  EA0C        STX    XMEM
0084  0057  C41D        LXP    :1D
0085  0058  6F39        WRX    7,1
0086  0059  FA10        JST    VCT1
0087  005A  0528        XRP
0088  005B  FA24        JST    SB2
0089  005C  B206        LDA    XMEM
0090  005D  FA0C        JST    VCT1
0091  005E  0528        XRP
0092  005F  FA20        JST    SB2
0093  0060  F70C        RTN    STPT
0094  0061  0000  INV   DATA   0
0095  0062  0000  DASH  DATA   0
0096  0063  0000  XMEM  DATA   0
0097  0064  0000  MEM   DATA   0
0098  0065  0800  STAMD ENT
```

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```
PAGE  0003

0099  0066  0000        NOP
0100  0067  0000        NOP
0101  0068  0000        NOP
0102  0069  F704        RTN    STAMD
0103  006A  0800  VCT1  ENT
0104  006B  0108        ZXR
0105  006C  3082        JAP    L1
0106  006D  0310        NAR
0107  006E  0528        XRP
0108  006F  9E0B  L1    STA    MEM
0109  0070  FA02        JST    SB1
0110  0071  B60D        LDA    MEM
0111  0072  F708        RTN    VCT1
0112  0073  0800  SB1   ENT
0113  0074  8206        AND    MSK1
0114  0075  1350        LLA    1
0115  0076  A205        IOR    MSK2
0116  0077  C101        CXI    1
0117  0078  A204        IOR    MSK3
0118  0079  6D39        WRA    7,1
0119  007A  F707        RTN    SB1
0120  007B  001F  MSK1  DATA   :1F
0121  007C  0040  MSK2  DATA   :40
0122  007D  0001  MSK3  DATA   :1
0123  007E  0020  MSK5  DATA   :20
0124  007F  03E0  MSK4  DATA   :3E0
0125  0080  0800  SB2   ENT
0126  0081  8602        AND    MSK4
0127  0082  13D4        LRA    5
0128  0083  A607        IOR    MSK2
0129  0084  C101        CXI    1
0130  0085  A607        IOR    MSK5
0131  0086  6D39        WRA    7,1
0132  0087  F707        RTN    SB2
0133  0088  0089  QFB   DATA   BFQ
0134  0089  C1CA  BFQ   TEXT   'AJAX@'
      008A  C1D8
      008B  C0A0
0135  008C  008D  RFB   DATA   BFR
0136  008D  C2D9  BFR   TEXT   'BYRON@'
      008E  D2CF
      008F  CEC0
0137  0090  0091  SFB   DATA   BFS
0138  0091  C3C1  BFS   TEXT   'CAESAR@'
      0092  C5D3
      0093  C1D2
      0094  C0A0
0139  0095  0096  TFB   DATA   BFT
0140  0096  C4D2  BFT   TEXT   'DRYDEN@'
      0097  D9C4
      0098  C5CE
      0099  C0A0
0141  009A  009B  UFB   DATA   BFU
```

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```
PAGE  0004

0142  009B  C5D5  BFU     TEXT    'EUCLID@'
      009C  C3CC
      009D  C9C4
      009E  C0A0
0143  009F  0800  LINZ    ENT
0144  00A0  0800          HLT             :88
0145  00A1  C61D          LAP     035
0146  00A2  6D3B          WRA     :3B
0147  00A3  B699          LDA     GRAS
0148  00A4  F201          JMP     $+2
0149  00A5  B232          LDA     TPN3
0150  00A6  00D0          DAR.
0151  00A7  9A30          STA     TPN3
0152  00A8  2104          JAZ     LINZ0
0153  00A9  B230          LDA     TPN5
0154  00AA  8A2E          ADD     TPN4
0155  00AB  9A2E          STA     TPN5
0156  00AC  F607          JMP     $-7
0157  00AD  B7AD  LINZ0   LDA     *XGRA1
0158  00AE  8A28          ADD     TPN5
0159  00AF  9E5E          STA     XPTR
0160  00B0  B7AF          LDA     *YGRA1
0161  00B1  8A28          ADD     TPN5
0162  00B2  9E60          STA     YPTR
0163  00B3  B762  LINZ1   LDA     *XPTR
0164  00B4  D221          CMS     TPN1
0165  00B5  0000          NOP
0166  00B6  F201          JMP     LINZ2
0167  00B7  F206          JMP     LINZ3
0168  00B8  D21E  LINZ2   CMS     TPN2
0169  00B9  0000          NOP
0170  00BA  F20A          JMP     DOVEC
0171  00BB  0110          ZAR
0172  00BC  9A1D          STA     TPN5
0173  00BD  F71E          RTN     LINZ
0174  00BE  DE6D  LINZ3   IMS     XPTR
0175  00BF  B76E          LDA     *XPTR
0176  00C0  E76E          LDX     *YPTR
0177  00C1  FE6D          JST     STPT
0178  00C2  DE71  LINZ4   IMS     XPTR
0179  00C3  DE71          IMS     YPTR
0180  00C4  F611          JMP     LINZ1
0181  00C5  E773  DOVEC   LDX     *YPTR
0182  00C6  FA01          JST     LVCT
0183  00C7  F605          JMP     LINZ4
0184  00C8  0800  LVCT    ENT
0185  00C9  0000          NOP
0186  00CA  FE65          JST     STAMD
0187  00CB  EE68          STX     XMEM
0188  00CC  C41E          LXP     :1E
0189  00CD  6F39          WRX     7,1
0190  00CE  FE64          JST     VCT1
0191  00CF  E66E          LDX     INV
```

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```
0192  00D0  FE50          JST    SB2
0193  00D1  B66E          LDA    XMEM
0194  00D2  FE68          JST    VCT1
0195  00D3  E671          LDX    DASH
0196  00D4  FE54          JST    SB2
0197  00D5  F70D          RTN    LVCT
0198  00D6  00C0  TPN1    DATA   192
0199  00D7  FFFF  TPN2    DATA   :FFFF
0200  00D8  0000  TPN3    DATA   0
0201  00D9  002D  TPN4    DATA   45
0202  00DA  0000  TPN5    DATA   0
0203                      END
0000 ERRORS
```

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```
AJA     0021      BFQ     0089      BFR     008D      BFS     0091
BFT     0096      BFU     009B      BUFAD   0004      BYRO    0027
CAES    002D      CNTR    0050      CNT     004F      DASH    0062
DOVEC   00C5      DRYD    0033  X   GRAS    000A  X   GRAX    0005
INV     0061      I1      0014      I2      0042  X   LINZ    009F
LINZ0   00AD      LINZ1   00B3      LINZ2   00B8      LINZ3   00BE
LINZ4   00C2  X   LVCT    00C8      L1      006F      MAIN    0002
MEM     0064      MSK1    007B      MSK2    007C      MSK3    007D
MSK4    007F      MSK5    007E  X   NAMZ    000B      PRIN    0003
QFB     0088      RFB     008C      SB1     0073      SB2     0030
SFB     0090      STAMD   0065  X   STPT    0054      TFB     0095
TPN1    00D6      TPN2    00D7      TPN3    00D8      TPN4    00D9
TPN5    00DA      UFB     009A      VCT1    006A      WRIT    0036
WRITI   0039      XCN     0053      XGRA1   0000      XMEM    0063
XPTR    0051      X       0044      X1      0043      YGRA1   0001
YPTR    0052      Y       004A      Y1      0049
```

?

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```
0001  NAM XGRA1,YGRA1
0002  MACH 4
0003  REL 0
0004 XGRA1 DATA XGRA
0005 XGRA DATA 192,-225,235,-15,0,15,215
0006  DATA -100,-135,15,0,-15,-115,-100
0007  DATA 375,-15,13,2,115
0008  DATA -165,15,-15,0,-100
0009  DATA -100,0,15,-15,-165
0010  DATA 115,-2,-13,15,375
0011  DATA 192,-80,:FFFF,0,0,0
0012  DATA 0,0,0,0,0
0013  DATA 192,-225,235,-15,0,15,215
0014  DATA -100,-135,15,0,-15,-115,-100
0015  DATA -20,20,-35,15,-20
0016  DATA 275,-15,0,15,255
0017  DATA -165,15,-15,0,-100
0018  DATA -100,0,15,-15,-165
0019  DATA 115,-2,-13,15,375
0020  DATA 192,-80,:FFFF,0,0,0
0021  DATA 192,-225,-20,20,-35,15,-20
0022  DATA 115,-2,-13,15,375
0023  DATA -235,15,0,-15,-215
0024  DATA 192,265,0,-95,15,-15,0,-90,-80
0025  DATA 0,100,0,-15,15,80,85
0026  DATA 192,-80,:FFFF,0,0,0,0,0,0,0,0,0
0027  DATA 192,-225,235,-15,0,15,215
0028  DATA -375,15,-13,-2,-115
0029  DATA 145,-15,15,0,120
0030  DATA 192,265,0,-95,15,-15,0,-90,-80
0031  DATA 0,100,0,-15,15,80,85
0032  DATA -375,2,13,-15,-115
0033  DATA 192,-80,:FFFF,0,0,0,0
0034  DATA 192,-265,20,13,-26,13,20
0035  DATA 235,-15,0,15,215
0036  DATA -375,15,-13,-2,-115
0037  DATA 145,-15,15,0,120
0038  DATA 120,15,-15,0,145
0039  DATA 0,-95,15,-15,0,-90,-80
0040  DATA 192,265,-265,15,0,-15,-265
0041  DATA 192,-80,:FFFF,0
0042  DATA 192,-200,100,25,-50,25,100,:FFFF
0043  RES 37
0044  DATA 192,0,100,-25,50,-25,100,:FFFF
0045  RES 37
0046  DATA 192,-135,135,0,0,0,135,:FFFF
0047  RES 37
0048 YGRA1 DATA YGRA
0049 YGRA DATA -355,0,15,-30,15,0
0050  DATA -70,0,15,-30,15,0,70
0051  DATA 310,2,-17,15,90
0052  DATA 175,0,-15,15,110
0053  DATA -110,15,-15,0,-175
```

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PAGE 0001

```
0001                        NAM   TEST1,RESP,INKS,TES21
0002                        NAM   H80
0003                        NAM   TES1A,SORC
0004        0004            MACH  4
0005  0000  .               REL   0
0006  0000        WATE1     REF
0007  0001        BUFAD     REF
0008  0002        MAIN      REF
0009  0003        SEG3      REF
0010  0004        SEG4      REF
0011  0005        SEG5      REF
0012  0006        E         REF
0013  0007        R         REF
0014  0008        RITE      REF
0015  0009        BEGIN     REF
0016  000A        SEG6      REF
0017  000B        SEG7      REF
0018  000C        SEG8      REF
0019  000D        CONF      REF
0020  000E  0000  TEST1     NOP
0021  000F  C612            LAP   022
0022  0010  6D3B            WRA   :3B       DISABLE ECHO
0023  0011  F209            JMP   TEST3     CHT INPUT
0024  0012  C605            LAP   5
0025  0013  FF13            JST   *WATE1    1/2 SEC
0026  0014  B2B1            LDA   TTIM
0027  0015  0150            IAR
0028  0016  9AAF            STA   TTIM
0029  0017  92AD            SUB   TTIMU
0030  0018  314A            JAN   TEST1
0031  0019  F272            JMP   TES20
0032  001A  0800  TES1A     ENT
0033  001B  493B  TEST3     SEN   :3B
0034  001C  F601            JMP   $-1
0035  001D  4039            SEL   :39
0036  001E  5939            RDA   :39
0037  001F  A2AF            IOR   H80
0038  0020  9AA6            STA   RESP
0039  0021  B2A6            LDA   SORC
0040  0022  3125            JAN   TES10
0041  0023  0350            ARP
0042  0024  9AA3            STA   SORC
0043  0025  B71E            LDA   *R
0044  0026  C0FE            CAI   :FE
0045  0027  F201            JMP   T3
0046  0028  F204            JMP   $+5
0047  0029  B29D  T3        LDA   RESP
0048  002A  C0D8            CAI   'X'
0049  002B  F239            JMP   TES15
0050  002C  F201            JMP   $+2
0051  002D  B299            LDA   RESP
0052  002E  C0C1            CAI   'A'
0053  002F  F20B            JMP   TEST4
```

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```
0054 0030 C0C2        CAI   'B'
0055 0031 F20B        JMP   TEST5
0056 0032 C0C3        CAI   'C'
0057 0033 F20B        JMP   TEST6
0058 0034 C0C4        CAI   'D'
0059 0035 F20B        JMP   TEST7
0060 0036 C0C5        CAI   'E'
0061 0037 F20B        JMP   TEST8
0062 0038 0110        ZAR
0063 0039 9A8E        STA   SORC
0064 003A F62C        JMP   TEST1   NOT VALID-IGNORE
0065 003B B256 TEST4  LDA   JFB
0066 003C F207        JMP   TEST9
0067 003D B25B TEST5  LDA   KFB
0068 003E F205        JMP   TEST9
0069 003F B260 TEST6  LDA   LFB
0070 0040 F203        JMP   TEST9
0071 0041 B265 TEST7  LDA   MFB
0072 0042 F201        JMP   TEST9
0073 0043 B26A TEST8  LDA   NFB
0074 0044 9F43 TEST9  STA   *BUFAD
0075 0045 FF43        JST   *MAIN
0076 0046 FF43        JST   *SEG3   MATCH RESPONS
0077 0047 F21D        JMP   TES15
0078 0048 0000 TES10  NOP
0079 0049 B27D        LDA   RESP
0080 004A C0D2        CAI   'R'
0081 004B F205        JMP   TES11
0082 004C C0CF        CAI   'O'
0083 004D F205        JMP   TES12
0084 004E C0D4        CAI   'T'
0085 004F F205        JMP   TES13
0086 0050 F642        JMP   TEST1   INVALID
0087 0051 B263 TES11  LDA   QFB
0088 0052 F203        JMP   TES14
0089 0053 B264 TES12  LDA   RFB
0090 0054 F201        JMP   TES14
0091 0055 B265 TES13  LDA   SFB
0092 0056 9F55 TES14  STA   *BUFAD
0093 0057 FF55        JST   *MAIN
0094 0058 FF55        JST   *SEG3
0095 0059 0110        ZAR
0096 005A 9A6D        STA   SORC
0097 005B B274        LDA   SETO
0098 005C 2106        JAZ   TS14
0099 005D B260        LDA   TFB
0100 005E 9F5D        STA   *BUFAD
0101 005F FF5D        JST   *MAIN
0102 0060 0110        ZAR
0103 0061 9A6E        STA   SETO
0104 0062 F202        JMP   TES15
0105 0063 0350 TS14   ARP
0106 0064 9A6B        STA   SETO
```

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```
0107 0065 DA5E TES15  IMS   INKS
0108 0066 DA66        IMS   FORE
0109 0067 B265        LDA   FORE
0110 0068 C004        CAI   4
0111 0069 F207        JMP   ATES17
0112 006A B763        LDA   *R
0113 006B C0FE        CAI   :FE
0114 006C F752        RTN   TES1A
0115 006D B256 ATES   LDA   INKS
0116 006E 925F        SUB   THIR2
0117 006F 210A        JAZ   TES16
0118 0070 F662        JMP   TEST1
0119 0071 0110 ATES17 ZAR
0120 0072 9A5A        STA   FORE
0121 0073 B255        LDA   UFB
0122 0074 9F73        STA   *BUFAD
0123 0075 FF73        JST   *MAIN
0124 0076 B76F        LDA   *R
0125 0077 C0FE        CAI   :FE
0126 0078 F75E        RTN   TES1A
0127 0079 F60C        JMP   ATES
0128 007A 9A49 TES16  STA   INKS
0129 007B B774        LDA   *R
0130 007C C0FF        CAI   :FF
0131 007D F763        RTN   TES1A
0132 007E FF7A        JST   *SEG4   CONFID.
0133 007F FF7A        JST   *SEG5
0134 0080 B250        LDA   CRIT
0135 0081 9779        SUB   *RITE
0136 0082 3185        JAG   TES17
0137 0083 0110        ZAR
0138 0084 9F7C        STA   *RITE
0139 0085 9F7E        STA   *R
0140 0086 DF80 TS16   IMS   *E      BUMP EPOCH
0141 0087 F77E        JMP   *BEGIN
0142 0088 DF81 TES17  IMS   *R      REPEAT NO.
0143 0089 0110        ZAR
0144 008A 9F82        STA   *RITE
0145 008B F782        JMP   *BEGIN
0146 008C F67E TES20  JMP   TEST1
0147 008D 0801 TES21  STOP  1
0148 008E FF84        JST   *SEG6   END BLOCK
0149 008F FF84        JST   *SEG7
0150 0090 0802        STOP  2
0151 0091 F785        JMP   *SEG8   INTERROGATE
0152 0092 0093 JFB    DATA  BFJ
0153 0093 A0A0 BFJ    TEXT  '  AJAX  0'
     0094 A0C1
     0095 CAC1
     0096 D8A0
     0097 A0A0
     0098 C0A0
0154 0099 009A KFB    DATA  BFK
```

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PAGE  0004

0155  009A  A0A0  BFK     TEXT    '   BYRON  @'
      009B  A0C2
      009C  D9D2
      009D  CFCE
      009E  A0A0
      009F  C0A0
0156  00A0  00A1  LFB     DATA    BFL
0157  00A1  A0A0  BFL     TEXT    '   CAESAR @'
      00A2  A0C3
      00A3  C1C5
      00A4  D3C1
      00A5  D2A0
      00A6  C0A0
0158  00A7  00A8  MFB     DATA    BFM
0159  00A8  A0A0  BFM     TEXT    '   DRYDEN @'
      00A9  A0C4
      00AA  D2D9
      00AB  C4C5
      00AC  CEA0
      00AD  C0A0
0160  00AE  00AF  NFB     DATA    BFN
0161  00AF  A0A0  BFN     TEXT    '   EUCLID @'
      00B0  A0C5
      00B1  D5C3
      00B2  CCC9
      00B3  C4A0
      00B4  C0A0
0162  00B5  00B6  QFB     DATA    BFQ
0163  00B6  A8D2  BFQ     TEXT    '(R)@'
      00B7  A9C0
0164  00B8  00B9  RFB     DATA    BFR
0165  00B9  A8CF  BFR     TEXT    '(O)@'
      00BA  A9C0
0166  00BB  00BC  SFB     DATA    BFS
0167  00BC  A8D4  BFS     TEXT    '(T)@'
      00BD  A9C0
0168  00BE  00BF  TFB     DATA    BFT
0169  00BF  A0D3  BFT     TEXT    ' SENDS TO@'
      00C0  C5CE
      00C1  C4D3
      00C2  A0D4
      00C3  CFC0
0170  00C4  0000  INKS    DATA    0
0171  00C5  0014  TTIMU   DATA    20
0172  00C6  0000  TTIM    DATA    0
0173  00C7  0000  RESP    DATA    0
0174  00C8  0000  SORC    DATA    0
0175  00C9  00CA  UFB     DATA    BFU
0176  00CA  000A  BFU     DATA    10,13,'@'
      00CB  000D
      00CC  00C0
0177  00CD  0000  FORE    DATA    0
0178  00CE  0020  THIR2   DATA    32
```

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```
PAGE  0005

0179  00CF  0080  H80     DATA    :80
0180  00D0  0001  SETO    DATA    1
0181  00D1  0020  CRIT    DATA    32
0182                      END
0000 ERRORS
```

```
PAGE  0006

    ATES     006D      ATES17  0071      BEGIN   0009      BFJ     0093
    BFK      009A      BFL     00A1      BFM     00A8      BFN     00AF
    BFQ      00B6      BFR     00B9      BFS     00BC      BFT     00BF

?
```

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```
PAGE  0001

0001                        NAM   SEG3,RITE
0002          0004          MACH  4
0003  0000                  REL   0
0004  0000          E       REF
0005  0001          INKS    REF
0006  0002          RESP    REF
0007  0003  0800    SEG3    ENT
0008  0004  B704            LDA   *E
0009  0005  00D0            DAR
0010  0006  9AB9            STA   E3
0011  0007  2105            JAZ   SE4
0012  0008  B2B3            LDA   ADDO
0013  0009  8AB1            ADD   INC
0014  000A  9AB1            STA   ADDO
0015  000B  B2B4            LDA   E3
0016  000C  F607            JMP   $-7
0017  000D  B20B    SE4     LDA   TPTR
0018  000E  8AAD            ADD   ADDO
0019  000F  8F0E            ADD   *INKS
0020  0010  9AAE            STA   STPT    BUF OF NEXT TABL ENTRY
0021  0011  B3AD            LDA   *STPT
0022  0012  D710            CMS   *RESP
0023  0013  0000            NOP
0024  0014  F201            JMP   SE5     WRONG
0025  0015  DAA4            IMS   RITE    CORRECT
0026  0016  0110    SE5     ZAR
0027  0017  9AA4            STA   ADDO
0028  0018  F715            RTN   SEG3
0029  0019  001A    TPTR    DATA  TABL
0030  001A  00C2    TABL    DATA  'B','R','A','R','D','T','C','T','D'
      001B  00D2
      001C  00C1
      001D  00D2
      001E  00C4
      001F  00D4
      0020  00C3
      0021  00D4
      0022  00C4
0031  0023  00D4            DATA  'T','B','R','B','R','A','R','A','R','E'
      0024  00C2
      0025  00D2
      0026  00C2
      0027  00D2
      0028  00C1
      0029  00D2
      002A  00C1
      002B  00D2
      002C  00C5
0032  002D  00CF            DATA  'O','E','O','C','T','C','T','D','T','D'
      002E  00C5
      002F  00CF
      0030  00C3
      0031  00D4
```

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```
PAGE  0002

      0032  00
      0033  00
      0034  00
      0035  00
      0036  00
      0037  00
      0038  00
      0039  00
0033  003A  00
      003B  00
      003C  00
      003D  00
      003E  00
      003F  00
      0040  00
      0041  00
      0042  00
      0043  00
0034  0044  00
      0045  00
      0046  00
      0047  00
      0048  00
      0049  00
      004A  00
      004B  00
      004C  00
      004D  00
0035  004E  00
      004F  00
      0050  00
      0051  00
      0052  00
      0053  00
      0054  00
      0055  00
      0056  00
      0057  00
      0058  00
      0059  00
0036  005A  00
      005B  00
      005C  00
      005D  00
      005E  00
      005F  00
      0060  00
      0061  00
0037  0062  00
      0063  00
      0064  00
      0065  00
      0066  00
```

```
PAGE  0002

      0032  00C3
      0033  00D4
      0034  00C4
      0035  00D4
      0036  00C4
      0037  00D4
      0038  00C3
      0039  00D4
0033  003A  00C4        DATA   'D','T','E','O','E','O','B','R','B','R'
      003B  00D4
      003C  00C5
      003D  00CF
      003E  00C5
      003F  00CF
      0040  00C2
      0041  00D2
      0042  00C2
      0043  00D2
0034  0044  00C1        DATA   'A','R','D','T','C','T','B','R','A','R'
      0045  00D2
      0046  00C4
      0047  00D4
      0048  00C3
      0049  00D4
      004A  00C2
      004B  00D2
      004C  00C1
      004D  00D2
0035  004E  00C1        DATA   'A','R','E','O','E','O','C','T','C','T'
      004F  00D2
      0050  00C5
      0051  00CF
      0052  00C5
      0053  00CF
      0054  00C3
      0055  00D4
      0056  00C3
      0057  00D4
      0058  00C4
      0059  00D4
0036  005A  00C4        DATA   'D','T','E','O','E','O','C','T'
      005B  00D4
      005C  00C5
      005D  00CF
      005E  00C5
      005F  00CF
      0060  00C3
      0061  00D4
0037  0062  00C2        DATA   'B','R','A','R','D','T','E','O'
      0063  00D2
      0064  00C1
      0065  00D2
      0066  00C4
```

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```
                0067  00D4
                0068  00C5
                0069  00CF
0038            006A  00C5      DATA   'E','O','C','T','B','R','A','R'
                006B  00CF
                006C  00C3
                006D  00D4
                006E  00C2
                006F  00D2
                0070  00C1
                0071  00D2
0039            0072  00C3      DATA   'C','T','D','T','A','R','B','R'
                0073  00D4
                0074  00C4
                0075  00D4
                0076  00C1
                0077  00D2
                0078  00C2
                0079  00D2
0040            007A  00C4      DATA   'D','T','C','T','B','R','A','R'
                007B  00D4
                007C  00C3
                007D  00D4
                007E  00C2
                007F  00D2
                0080  00C1
                0081  00D2
0041            0082  00C2      DATA   'B','R','D','T','D','T','C','T'
                0083  00D2
                0084  00C4
                0085  00D4
                0086  00C4
                0087  00D4
                0088  00C3
                0089  00D4
0042            008A  00C3      DATA   'C','T','E','O','E','O','A','R'
                008B  00D4
                008C  00C5
                008D  00CF
                008E  00C5
                008F  00CF
                0090  00C1
                0091  00D2
0043            0092  00C1      DATA   'A','R','B','R','B','R','A','R'
                0093  00D2
                0094  00C2
                0095  00D2
                0096  00C2
                0097  00D2
                0098  00C1
                0099  00D2
0044            009A  00C4      DATA   'D','T','C','T','B','R','A','R'
                009B  00D4
```

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PAGE  0004

      009C  00C3
      009D  00D4
      009E  00C2
      009F  00D2
      00A0  00C1
      00A1  00D2
0045  00A2  00C4          DATA   'D','T','C','T','B','R','E','O'
      00A3  00D4
      00A4  00C3
      00A5  00D4
      00A6  00C2
      00A7  00D2
      00A8  00C5
      00A9  00CF
0046  00AA  00C5          DATA   'E','O','A','R','A','R','B','R'
      00AB  00CF
      00AC  00C1
      00AD  00D2
      00AE  00C1
      00AF  00D2
      00B0  00C2
      00B1  00D2
0047  00B2  00C4          DATA   'D','T','C','T','C','T','E','O'
      00B3  00D4
      00B4  00C3
      00B5  00D4
      00B6  00C3
      00B7  00D4
      00B8  00C5
      00B9  00CF
0048  00BA  0000  RITE    DATA   0
0049  00BB  0020  INC     DATA   32
0050  00BC  0000  ADDO    DATA   0
0051  00BD  00BE  RPTR    DATA   RESPS
0052  00BE  0000  RESPS   DATA   0
0053  00BF  0000  STPT    DATA   0
0054  00C0  0000  E3      DATA   0
0055                      END
0000 ERRORS



PAGE  0005

   ADDO    00BC      E       0000     E3      00C
```

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```
0001                        NAM     SEG4,CONF
0002          0004          MACH    4
0003  0000                  REL     0
0004  0000    LVCT  REF
0005  0001    ERAS  REF
0006  0002    MAIN  REF
0007  0003    BUFAD REF
0008  0004    STPT  REF
0009  0005  0800  SEG4    ENT             CONFIDENCE
0010  0006  B286          LDA     CONFI
0011  0007  9A80          STA     CONF
0012  0008  B245          LDA     AFB
0013  0009  9F06          STA     *BUFAD
0014  000A  FF08          JST     *MAIN
0015  000B  C61D          LAP     035
0016  000C  6D3B          WRA     :3B
0017  000D  B276          LDA     XPTR
0018  000E  0108          ZXR
0019  000F  FF0B          JST     *STPT
0020  0010  C61E          LAP     036
0021  0011  6D3B          WRA     :3B
0022  0012  FA01          JST     SEG4A
0023  0013  F208          JMP     SEG4B
0024  0014  0800  SEG4A    ENT
0025  0015  0110          ZAR
0026  0016  E26E          LDX     STOR7
0027  0017  FF17          JST     *LVCT
0028  0018  0110          ZAR
0029  0019  E26C          LDX     STOR8
0030  001A  FF1A          JST     *LVCT
0031  001B  F707          RTN     SEG4A
0032  001C  B26A  SEG4B    LDA     STOR9
0033  001D  0108          ZXR
0034  001E  FF1E          JST     *LVCT
0035  001F  FE0B          JST     SEG4A
0036  0020  B266          LDA     STOR9
0037  0021  0108          ZXR
0038  0022  FF22          JST     *LVCT
0039  0023  FE0F          JST     SEG4A
0040  0024  C61D          LAP     035
0041  0025  6D3B          WRA     :3B
0042  0026  0110          ZAR
0043  0027  0108          ZXR
0044  0028  FF24          JST     *STPT   CENTRE CURSOR
0045  0029  C61C          LAP     034
0046  002A  6D3B          WRA     :3B
0047  002B  493B  S4C     SEN     :3B     GET CHT
0048  002C  F601          JMP     $-1
0049  002D  4039          SEL     :39
0050  002E  5939          RDA     :39
0051  002F  A259          IOR     H80
0052  0030  9A59          STA     RESP    STOR CHT
0053  0031  C0D8          CAI     'X'     DONE?
```

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```
PAGE  0002

0054  0032  F218          JMP    OUT       YES
0055  0033  C0A0          CAI    :A0 MORE
0056  0034  F203          JMP    MOR
0057  0035  C088          CAI    :88
0058  0036  F209          JMP    LES
0059  0037  F60C          JMP    S4C       INVALID GO BAC
0060  0038  B24F  MOR     LDA    CONF
0061  0039  9252          SUB    THOU
0062  003A  214F          JAZ    S4C       MAX
0063  003B  B24C          LDA    CONF
0064  003C  8A4E          ADD    TW5       +25
0065  003D  9A4A          STA    CONF
0066  003E  FA08          JST    PRIN
0067  003F  F614          JMP    S4C
0068  0040  B247  LES     LDA    CONF
0069  0041  C000          CAI    0         MIN?
0070  0042  F617          JMP    S4C       YES
0071  0043  9247          SUB    TW5       -25
0072  0044  9A43          STA    CONF
0073  0045  FA01          JST    PRIN
0074  0046  F61B          JMP    S4C
0075  0047  0800  PRIN    ENT
0076  0048  B241          LDA    RESP
0077  0049  6D3B          WRA    :3B
0078  004A  F703          RTN    PRIN
0079  004B  FF4A  OUT     JST    *ERAS
0080  004C  0000          NOP
0081  004D  F748          RTN    SEG4
0082  004E  004F  AFB     DATA   BFA
0083  004F  000A  BFA     DATA   10,13,10,13,10,13
      0050  000D
      0051  000A
      0052  000D
      0053  000A
      0054  000D
0014  0055  A0A0          TEXT   '   HOW CONFIDENT ARE YOU ?'
      0056  A0C8
      0057  CFD7,
      0058  A0C3
      0059  CFCE
      005A  C6C9
      005B  C4C5
      005C  CED4
      005D  A0C1
      005E  D2C5
      005F  A0D9
      0060  CFD5
      0061  A0BF
0085  0062  000A          DATA   10,13,10,13
      0063  000D
      0064  000A
      0065  000D
0086  0066  CECF          TEXT   'NO IDEA
```

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PAGE  0003

      0067  A0C9
      0068  C4C5
      0069  C1A0
      006A  A0A0
      006B  A0A0
      006C  A0A0
      006D  A0A0
      006E  A0A0
      006F  A0A0
      0070  A0A0
      0071  A0A0
      0072  A0A0
0087  0073  A0A0          TEXT    '                SUKE'
      0074  A0A0
      0075  A0A0
      0076  A0A0
      0077  A0A0
      0078  A0A0
      0079  A0A0
      007A  A0A0
      007B  D3D5
      007C  D2C5
0088  007D  000A          DATA    10,13,10,13,10,13
      007E  000D
      007F  000A
      0080  000D
      0081  000A
      0082  000D
0089  0083  00C0          DATA    '@'
0090  0084  FFE3  XPTR    DATA    -285
0091  0085  001E  STOR7   DATA    30
0092  0086  FFE2  STOR8   DATA    -30
0093  0087  011D  STOR9   DATA    285
0094  0088  01F4  CONF    DATA    500
0095  0089  0080  H80     DATA    :80
0096  008A  0000  RESP    DATA    0
0097  008B  0019  TW5     DATA    25
0098  008C  03E8  THOU    DATA    1000
0099  008D  01F4  CONF1   DATA    500
0100                      END
0000 ERRORS


PAGE  0004

    AFB     004E      BFA     004F      BUFAD   0003  X   CONF    0088
    CONF1   008D      ERAS    0001
?
```

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?XA.

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?XE.0000 ERRORS

?XA.


PAGE  0001

0001                          NAM     SEG5,SEG6,XPTR8
0002          0004            MACH    4
0003  0000                    REL     0
0004  0000          E         REF
0005  0001          R         REF
0006  0002          CONF      REF
0007  0003          RITE      REF
0008  0004  0800    SEG5      ENT                 SCORE RECORDING
0009  0005  B705              LDA     *E
0010  0006  9B12              STA     *XPTR
0011  0007  DA11              IMS     XPTR
0012  0008  B707              LDA     *R
0013  0009  9B0F              STA     *XPTR
0014  000A  DA0E              IMS     XPTR
0015  000B  B708              LDA     *RITE
0016  000C  9B0C              STA     *XPTR
0017  000D  DA0B              IMS     XPTR
0018  000E  B70C              LDA     *CONF
0019  000F  9B09              STA     *XPTR
0020  0010  DA08              IMS     XPTR
0021  0011  F70D              RTN     SEG5
0022  0012  0800    SEG6      ENT                 END BLOCK 1
0023  0013  0000    SEG6A     NOP
0024  0014  B202              LDA     FS
0025  0015  9B03              STA     *XPTR
0026  0016  F704              RTN     SEG6
0027  0017  FFFF    FS        DATA    :FFFF
0028  0018  001A    XPTR8     DATA    RXPT
0029  0019  001A    XPTR      DATA    RXPT
0030  001A          RXPT      RES     500
0031                          END
0000 ERRORS


PAGE  0002

     CONF    0002      E       0000      FS      0017      RITE    0003
     RXPT    001A      R       0001  X   SEG5    0004      SEG6A   0013
X    SEG6    0012      XPTR    0019  X   XPTR8   0018
```

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```
PAGE  0001

0001                        NAM   SEG7,SPAC1,PYR
0002        0004            MACH  4
0003  0000                  REL   0
0004  0000        WATE1     REF
0005  0001        ODEC      REF
0006  0002        MAIN      REF
0007  0003        BUFAD     REF
0008  0004        XPTR8     REF
0009  0005  0800  SEG7      ENT             PRINTOUT
0010  0006  0000            NOP
0011  0007  B23F            LDA   AFB
0012  0008  9F05            STA   *BUFAD
0013  0009  FF07            JST   *MAIN
0014  000A  C605            LAP   5
0015  000B  FF0B            JST   *WATE1
0016  000C  B708            LDA   *XPTR8    RESULT BUFF
0017  000D  9A38            STA   XPTR
0018  000E  B337            LDA   *XPTR
0019  000F  D235  SEG8A     CMS   ESTR
0020  0010  0000            NOP
0021  0011  F203            JMP   PYR       UNEQUAL PRIN YER
0022  0012  C608            LAP   8
0023  0013  FA09            JST   SPAC1     8 SPACS
0024  0014  F212            JMP   NEX
0025  0015  9A2F  PYR       STA   ESTR      STOR EPOC
0026  0016  B22D            LDA   BASE
0027  0017  8A2D            ADD   ESTR
0028  0018  0F00            SWM
0029  0019  FF18            JST   *ODEC
0030  001A  C604            LAP   4
0031  001B  FA01            JST   SPAC1
0032  001C  F20A            JMP   NEX
0033  001D  0800  SPAC1     ENT
0034  001E  9A40  SPAC2     STA   SPAS      STOR NO OF SPACS
0035  001F  C000            CAI   0         FINISH?
0036  0020  F205            JMP   FIN       YES
0037  0021  C6A0            LAP   ' '   NO
0038  0022  6D3B            WRA   :3B
0039  0023  B23B            LDA   SPAS
0040  0024  00D0            DAR
0041  0025  F607            JMP   SPAC2
0042  0026  F709  FIN       RTN   SPAC1
0043  0027  DA1E  NEX       IMS   XPTR
0044  0028  B31D            LDA   *XPTR
0045  0029  0F00            SWM
0046  002A  FF29            JST   *ODEC
0047  002B  C607            LAP   7         REP NO +SPAC
0048  002C  FE0F            JST   SPAC1
0049  002D  DA18            IMS   XPTR
0050  002E  B317            LDA   *XPTR     PRIN SCOR
0051  002F  0F00            SWM
0052  0030  FF2F            JST   *ODEC
0053  0031  C607            LAP   7
```

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PAGE  0002

0054  0032  FE15          JST    SPAC1
0055  0033  DA12          IMS    XPTR
0056  0034  B311          LDA    *XPTR
0057  0035  0F00          SWM
0058  0036  FF35          JST    *ODEC     PRIN CONF
0059  0037  C60A          LAP    :0A
0060  0038  6D3B          WRA    :3B
0061  0039  C60D          LAP    :0D
0062  003A  6D3B          WRA    :3B
0063  003B  C605          LAP    5
0064  003C  FF3C          JST    *WATE1
0065  003D  DA08          IMS    XPTR
0066  003E  B307          LDA    *XPTR
0067  003F  D203          CMS    FS
0068  0040  0000          NOP
0069  0041  F632          JMP    SEG8A     NEXT 4
0070  0042  0800          HLT              END SYMBOL FOUND
0071  0043  FFFF  FS      DATA   :FFFF
0072  0044  07B7  BASE    DATA   1975
0073  0045  0000  ESTR    DATA   0
0074  0046  0000  XPTR    DATA   0
0075  0047  0048  AFB     DATA   BFA
0076  0048  000A  BFA     DATA   10,13
      0049  000D
0077  004A  D9C5          TEXT   'YEAR REPEAT SCORE\32 '
      004B  C1D2
      004C  A0D2
      004D  C5D0
      004E  C5C1
      004F  D4A0
      0050  D3C3
      0051  CFD2
      0052  C5DC
      0053  B3B2
      0054  A0A0
0078  0055  C3CF          TEXT   'CONF\1000'
      0056  CEC6
      0057  DCB1
      0058  B0B0
      0059  B0A0
0079  005A  000A          DATA   10,13,10,13,'e'
      005B  000D
      005C  000A
      005D  000D
      005E  00C0
0080  005F  0000  SPAS    DATA   0
0081                     END
0000 ERRORS
```

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```
PAGE  0001

0001                              NAM   SEG8,IKB,M
0002                              NAM   COR1,COT1,CRT1
0003          0004                MACH  4
0004  0000                        REL   0
0005  0000  0000  SEG8  NOP
0006  0001  FBA7        JST   *ERAS
0007  0002  B3AC        LDA   *CFB      SHOW SCORE
0008  0003  9BA4        STA   *BUFAD
0009  0004  FBA2        JST   *MAIN
0010  0005  B283        LDA   M
0011  0006  0F00        SWM
0012  0007  FBA4        JST   *ODEC
0013  0008  B3A5        LDA   *AFB      QUESTION
0014  0009  9B9E        STA   *BUFAD
0015  000A  FB9C        JST   *MAIN
0016  000B  C61D        LAP   035       SET PT
0017  000C  6D3B        WRA   :3B
0018  000D  C603        LAP   3         3 COUNTS.
0019  000E  9A7B        STA   CNTR
0020  000F  0110        ZAR
0021  0010  9A89        STA   CNT
0022  0011  B279        LDA   X1
0023  0012  9A91        STA   XPTR
0024  0013  B27B        LDA   Y1
0025  0014  9A90        STA   YPTR
0026  0015  B38E  A8    LDA   *XPTR
0027  0016  E38E        LDX   *YPTR     POSITIN BEAM
0028  0017  FB93        JST   *STPT
0029  0018  C61C        LAP   034       SYMBL MODE
0030  0019  6D3B        WRA   :3B
0031  001A  B26F        LDA   CNTR
0032  001B  00D0        DAR
0033  001C  9A6D        STA   CNTR
0034  001D  C002        CAI   2
0035  001E  F204        JMP   R8        RRURIT
0036  001F  C001        CAI   1
0037  0020  F204        JMP   O8        OLYMP
0038  0021  B38E  T8    LDA   *CUN0
0039  0022  F203        JMP   GO
0040  0023  B38D  R8    LDA   *CUN1
0041  0024  F201        JMP   GO
0042  0025  B38C  O8    LDA   *CUN2
0043  0026  9B81  GO    STA   *BUFAD
0044  0027  FB7F        JST   *MAIN
0045  0028  B261        LDA   CNTR
0046  0029  C000        CAI   0
0047  002A  F205        JMP   FIN
0048  002B  DA78        IMS   XPTR
0049  002C  DA78        IMS   YPTR
0050  002D  C61D        LAP   035       SET PT
0051  002E  6D3B        WRA   :3B
0052  002F  F61A        JMP   A8
0053  0030  0000  FIN   NOP
```

```
0054 0031 C612        LAP   022
0055 0032 6D3B        WRA   :3B       DISAB EKO
0056 0033 F207        JMP   GET
0057 0034 0800  IKB   ENT
0058 0035 493B        SEN   :3B
0059 0036 F601        JMP   $-1
0060 0037 4039        SEL   :39
0061 0038 5939        RDA   :39
0062 0039 A25F        IOR   H80
0063 003A F706        RTN   IKB
0064 003B 0000  GET   NOP
0065 003C FE08        JST   IKB       GET CHT
0066 003D C0C9        CAI   'I'       INFO REQUIRED?
0067 003E F201        JMP   MN
0068 003F F203        JMP   GET2
0069 0040 FB65  MN    JST   *MENU
0070 0041 F641        JMP   SEG8
0071 0042 FE0E  GET1  JST   IKB
0072 0043 C0D2  GET2  CAI   'R'
0073 0044 F205        JMP   STOR
0074 0045 C0CF        CAI   'O'
0075 0046 F203        JMP   STOR
0076 0047 C0D4        CAI   'T'
0077 0048 F201        JMP   STOR
0078 0049 F607        JMP   GET1      INVALID
0079 004A 0000  STOR  NOP
0080 004B DA4E        IMS   CNT       UP TO 6
0081 004C 8A4E        ADD   NUM1
0082 004D 9A4D        STA   NUM1      ADD BINARY VALUES OF PAIRS
0083 004E DA4D        IMS   NUM2      PAIR DETECTOR
0084 004F B24C        LDA   NUM2
0085 0050 C002        CAI   2
0086 0051 F201        JMP   PAIR
0087 0052 F610        JMP   GET1
0088 0053 0110  PAIR  ZAR
0089 0054 9A47        STA   NUM2      0 PAIR FLAG
0090 0055 B245        LDA   NUM1      COMBINATIOM CODE
0091 0056 D246        CMS   RO        R-O?
0092 0057 0000        NOP
0093 0058 F201        JMP   TWO       NO
0094 0059 F20D        JMP   COR       YES
0095 005A D243  TWO   CMS   OT        O-T?
0096 005B 0000        NOP
0097 005C F201        JMP   TRE       NO
0098 005D F206        JMP   COT       YES
0099 005E D240  TRE   CMS   RT        R-T?
0100 005F 0000        NOP
0101 0060 F209        JMP   INV       NO INVALID
0102 0061 C606  CRT   LAP   6         YES
0103 0062 9A3D        STA   CRT1      STOR RESULT
0104 0063 F214        JMP   BORD
0105 0064 C607  COT   LAP   7
0106 0065 9A3B        STA   COT1
```

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PAGE  0003

0107  0066  F211          JMP   BORD
0108  0067  C608    COR   LAP   8
0109  0068  9A39          STA   COR1
0110  0069  F20E          JMP   BORD
0111  006A  0110    INV   ZAR
0112  006B  9A2F          STA   NUM1      0 COMBINATION CODE
0113  006C  B22D          LDA   CNT       DIP 2
0114  006D  00D0          DAR
0115  006E  00D0          DAR
0116  006F  9A2A          STA   CNT
0117  0070  B227          LDA   BPTR      DIP 2
0118  0071  00D0          DAR
0119  0072  00D0          DAR
0120  0073  9A24          STA   BPTR
0121  0074  FE40          JST   IKB
0122  0075  C0D8          CAI   'X'
0123  0076  F20C          JMP   FINIS
0124  0077  F634          JMP   GET2      TRY ANOTHER PAIR
0125  0078  9B34    BORD  STA   *GRAS     EPOK 6,7,8
0126  0079  FB39          JST   *LINZ     BORDER LINE
0127  007A  B21F          LDA   CNT
0128  007B  C006          CAI   6
0129  007C  F206          JMP   FINIS
0130  007D  0110          ZAR
0131  007E  9A1C          STA   NUM1
0132  007F  FE4B          JST   IKB       GET NEX CHT
0133  0080  C0D8          CAI   'X'
0134  0081  F201          JMP   FINIS     FINISH
0135  0082  F63F          JMP   GET2      NOT YET
0136  0083  FB25    FINIS JST   *ERAS
0137  0084  FB2F          JST   *SEG4     CONFIDENCE
0138  0085  FB23          JST   *ERAS
0139  0086  B32E          LDA   *CONF
0140  0087  9A1B          STA   CONF1     STOR CONFIDENCE
0141  0088  F32D          JMP   *SEG9     NEX QUESTION
0142  0089  0032    M     DATA  50
0143  008A  0800    CNTR  HLT
0144  008B  008C    X1    DATA  XP
0145  008C  FEED    XP    DATA  -275,155,-90
      008D  009B
      008E  FFA6
0146  008F  0090    Y1    DATA  YP
0147  0090  0014    YP    DATA  20,20,-210
      0091  0014
      0092  FF2E
0148  0093  0094    B1    DATA  B0
0149  0094  0095    B0    DATA  BUFF
0150  0095  0000    BUFF  DATA  0,0,0
      0096  0000
      0097  0000
0151  0098  0000    BPTR  DATA  0
0152  0099  0080    H80   DATA  :80
0153  009A  0000    CNT   DATA  0
```

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0154  009B  0000  NUM1   DATA  0
0155  009C  0000  NUM2   DATA  0
0156  009D  01A1  RO     DATA  417
0157  009E  01A3  OT     DATA  419
0158  009F  01A6  RT     DATA  422
0159  00A0  0000  CRT1   DATA  0
0160  00A1  0000  COT1   DATA  0
0161  00A2  0000  COR1   DATA  0
0162  00A3  0000  CONF1  DATA  0
0163  00A4  0000  XPTR   DATA  0
0164  00A5  0000  YPTR   DATA  0
0165  00A6        MENU   REF
0166  00A7        MAIN   REF
0167  00A8        BUFAD  REF
0168  00A9        ERAS   REF
0169  00AA        WATE1  REF
0170  00AB        STPT   REF
0171  00AC        ODEC   REF
0172  00AD        GRAS   REF
0173  00AE        AFR    REF
0174  00AF        CFB    REF
0175  00B0        CUN0   REF
0176  00B1        CUN1   REF
0177  00B2        CUN2   REF
0178  00B3        LINZ   REF
0179  00B4        SEG4   REF
0180  00B5        CONF   REF
0181  00B6        SEG9   REF
0182              END
0000 ERRORS
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```
0001  NAM AFB,CFB,CUN0,CUN1,CUN2
0002  MACH 4
0003  REL 0
0004 AFB DATA BFA
0005 BFA DATA 10,13
0006  TEXT 'TYPE OUT THE PAIRS'
0007  TEXT ' OF COUNTRIES WHICH'
0008  DATA 10,13
0009  TEXT 'SHARE COMMON BORDERS'
0010  TEXT ' (INITIALS ONLY)'
0011  DATA 10,13
0012  TEXT 'PRESS X WHEN FINISHED'
0013  DATA 10,13
0014  TEXT 'IF YOU DON T KNOW AND NEED'
0015  TEXT ' INFORMATION PRESS I@'
0016 CFB DATA BFC
0017 BFC TEXT '   SCORE = @'
0018 CUN0 DATA C0
0019 C0 TEXT 'TRANSYLVANIA@'
0020 CUN1 DATA C1
0021 C1 TEXT 'RURITANIA@'
0022 CUN2 DATA C2
0023 C2 TEXT 'OLYMPIA@'
0024  END
0025  NAM MENU
0026  MACH 4
0027  REL 0
0028 MENU ENT
0029  STOP 3
0030  RTN MENU
0031  END

?
```

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```
0001                        NAM   SEG9,N,C,CONF2
0002                        NAM   RES1,RES2
0003          0004          MACH  4
0004  0000                  REL   0
0005  0000    0000  SEG9    NOP
0006  0001    FBA5          JST   *ERAS
0007  0002    B3A3          LDA   *CFB
0008  0003    9B9A          STA   *BUFAD
0009  0004    FBA0          JST   *MAIN     SCORE =
0010  0005    B3A2          LDA   *M
0011  0006    0F00          SWM
0012  0007    FBA1          JST   *ODEC
0013  0008    B3A3          LDA   *Q2       QUESTION
0014  0009    9B94          STA   *BUFAD
0015  000A    FB9A          JST   *MAIN
0016  000B    FA01  GET0    JST   GET
0017  000C    F21C          JMP   G2        GET 1ST CHT
0018  000D    0800  GET     ENT
0019  000E    C612  GET1    LAP   022
0020  000F    6D3B          WRA   :3B       ECO OFF
0021  0010    FB99          JST   *IKB      CHT INP
0022  0011    C0D8  GET2    CAI   'X'       END CHT?
0023  0012    F705          RTN   GET       YES
0024  0013    C0C1          CAI   'A'
0025  0014    F209          JMP   GA
0026  0015    C0C2          CAI   'B'
0027  0016    F209          JMP   GB
0028  0017    C0C3          CAI   'C'
0029  0018    F209          JMP   GC
0030  0019    C0C4          CAI   'D'
0031  001A    F209          JMP   GD
0032  001B    C0C5          CAI   'E'
0033  001C    F209          JMP   GE
0034  001D    F60F          JMP   GET1      INVALID
0035  001E    B390  GA      LDA   *AJA
0036  001F    F208          JMP   RETU
0037  0020    B38F  GB      LDA   *BYR
0038  0021    F206          JMP   RETU
0039  0022    B38E  GC      LDA   *CAE
0040  0023    F204          JMP   RETU
0041  0024    B38D  GD      LDA   *DRY
0042  0025    F202          JMP   RETU
0043  0026    B38C  GE      LDA   *EUC
0044  0027    F200          JMP   RETU
0045  0028    F71B  RETU    RTN   GET
0046  0029    C0D8  G2      CAI   'X'
0047  002A    F61F          JMP   GET0      CANT BE FIN YET
0048  002B    FA07  G2A     JST   SCOR1     RECORD
0049  002C    9B71          STA   *BUFAD
0050  002D    FB77          JST   *MAIN     SPY NAM PRIN
0051  002E    FA10          JST   FIN1      CHEK FOR 6
0052  002F    FE22          JST   GET       NEX CHT
0053  0030    C0D8          CAI   'X'       END?
```

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```
0054 0031 F213       JMP   G3      RURIT FINISH
0055 0032 F607       JMP   G2A     LOOP
0056 0033 0800 SCOR1 ENT
0057 0034 D37A       CMS   *AJA
0058 0035 0000       NOP
0059 0036 F201       JMP   $+2
0060 0037 F205       JMP   AD      +1
0061 0038 D377       CMS   *BYR
0062 0039 0000       NOP
0063 003A F201       JMP   $+2
0064 003B F201       JMP   AD
0065 003C F709       RTN   SCOR1
0066 003D DA59 AD    IMS   N       BUMP NEUTRAL
0067 003E F70B       RTN   SCOR1
0068 003F 0800 FIN1  ENT
0069 0040 B258       LDA   CNT
0070 0041 C004       CAI   4       5 DONE?
0071 0042 F237       JMP   EXIT    YES
0072 0043 DA55       IMS   CNT
0073 0044 F705       RTN   FIN1
0074 0045 B367 G3    LDA   *03     OLYMP
0075 0046 9B57       STA   *BUFAD
0076 0047 FB5D       JST   *MAIN
0077 0048 FE3B G3A   JST   GET
0078 0049 C0D8       CAI   'X'     CANT FIN YET
0079 004A F602       JMP   G3A
0080 004B FA07 G3B   JST   SCOR2
0081 004C 9B51       STA   *BUFAD
0082 004D FB57       JST   *MAIN
0083 004E FE0F       JST   FIN1
0084 004F FE42       JST   GET
0085 0050 C0D8       CAI   'X'     OLYM FINI
0086 0051 F20E       JMP   G4
0087 0052 F607       JMP   G3B
0088 0053 0800 SCOR2 ENT
0089 0054 D35E       CMS   *EUC
0090 0055 0000       NOP
0091 0056 F201       JMP   $+2
0092 0057 F201       JMP   AD1
0093 0058 F705       RTN   SCOR2
0094 0059 9A3E AD1   STA   SAV
0095 005A C601       LAP   1
0096 005B 9A3E       STA   CORR
0097 005C 8A3A       ADD   N
0098 005D 9A39       STA   N
0099 005E B239       LDA   SAV
0100 005F F70C       RTN   SCOR2   CORR
0101 0060 B34D G4    LDA   *04
0102 0061 9B3C       STA   *BUFAD
0103 0062 FB42       JST   *MAIN
0104 0063 FE56 G4A   JST   GET
0105 0064 C0D8       CAI   'X'
0106 0065 F602       JMP   G4A     CANT FIN YET
```

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```
0107 0066 FA07 G4B   JST   SCOR3
0108 0067 9B36       STA   *BUFAD
0109 0068 FB3C       JST   *MAIN   NAM
0110 0069 FE2A       JST   FIN1
0111 006A FE5D       JST   GET
0112 006B C0D8       CAI   'X'
0113 006C F20D       JMP   EXIT
0114 006D F607       JMP   G4B     LOOP
0115 006E 0800 SCOR3 ENT
0116 006F D342       CMS   *DRY
0117 0070 0000       NOP
0118 0071 F201       JMP   $+2
0119 0072 F205       JMP   AD2
0120 0073 D33D       CMS   *CAE
0121 0074 0000       NOP
0122 0075 F201       JMP   $+2
0123 0076 F201       JMP   AD2
0124 0077 F709       RTN   SCOR3
0125 0078 DA1E AD2   IMS   N
0126 0079 F70B       RTN   SCOR3
0127 007A B21C EXIT  LDA   N
0128 007B 9A20       STA   RES2    SCORE FOR QUES2
0129 007C B21D       LDA   CORR
0130 007D C001       CAI   1
0131 007E F201       JMP   COMP    EUC IN RITE COUNTRY
0132 007F F210       JMP   OUT
0133 0080 B323 COMP  LDA   *CRT1   CHEC COMM BORDS CORKT
0134 0081 C000       CAI   0
0135 0082 F201       JMP   OK1
0136 0083 F20C       JMP   OUT
0137 0084 B31E OK1   LDA   *COT1
0138 0085 C007       CAI   7
0139 0086 F201       JMP   OK2
0140 0087 F208       JMP   OUT
0141 0088 B319 OK2   LDA   *COR1
0142 0089 C008       CAI   8
0143 008A F201       JMP   OK
0144 008B F204       JMP   OUT
0145 008C C603 OK    LAP   3
0146 008D 9A0D       STA   RES1
0147 008E 8A07       ADD   C       BUMP COMPRHNSN
0148 008F 9A06       STA   C
0149 0090 FB16 OUT   JST   *ERAS
0150 0091 FB0F       JST   *SEG4
0151 0092 FB14       JST   *ERAS
0152 0093 B30C       LDA   *CONF
0153 0094 9A08       STA   CONF2   REC CONFDNCE
0154 0095 F309       JMP   *SEG10  NEX QUES
0155 0096 0000 C     DATA  0
0156 0097 0000 N     DATA  0
0157 0098 0000 SAV   DATA  0
0158 0099 0000 CNT   DATA  0
0159 009A 0000 CORR  DATA  0
```

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PAGE  0004

0160  009B  0000  RES1   DATA   0
0161  009C  0000  RES2   DATA   0
0162  009D  0000  CONF2  DATA   0
0163  009E        BUFAD  REF
0164  009F        SEG10  REF
0165  00A0        CONF   REF
0166  00A1        SEG4   REF
0167  00A2        COR1   REF
0168  00A3        COT1   REF
0169  00A4        CRT1   REF
0170  00A5        MAIN   REF
0171  00A6        CFB    REF
0172  00A7        ERAS   REF
0173  00A8        M      REF
0174  00A9        ODEC   REF
0175  00AA        IKB    REF
0176  00AB        MENU   REF
0177  00AC        Q2     REF
0178  00AD        Q3     REF
0179  00AE        Q4     REF
0180  00AF        AJA    REF
0181  00B0        BYR    REF
0182  00B1        CAE    REF
0183  00B2        DRY    REF
0184  00B3        EUC    REF
0185              END
0000 ERRORS
```

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PAGE  0005

    AD      003D     AD1     0059     AD2     0078     AJA     00AF
    BUFAD   009E     BYR     00B0     CAE     00B1     CFB     00A6
    CNT     0099     COMP    0080     CONF    00A0  X  CONF2   009D
    CORR    009A     COR1    00A2     COT1    00A3     CRT1    00A4
X   C       0096     DRY     00B2     ERAS    00A7     EUC     00B3
    EXIT    007A     FIN1    003F     GA      001E     GB      0020
    GC      0022     GD      0024     GET     000D     GET0    000B
    GET1    000E     GET2    0011     GE      0026     G2A     002B
    G2      0029     G3A     0048     G3B     004B     G3      0045
    G4A     0063     G4B     0066     G4      0060     IKB     00AA
    MAIN    00A5     MENU    00AB     M       00A8  X  N       0097
    ODEC    00A9     OK      008C     OK1     0084     OK2     0088
    OUT     0090     Q2      00AC     Q3      00AD     Q4      00AE
X   RES1    009B  X  RES2    009C     RETU    0028     SAV     0098
    SCOR1   0033     SCOR2   0053     SCOR3   006E     SEG10   009F
    SEG4    00A1  X  SEG9    0000
```

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PAGE  0001

0001                    NAM     Q2,Q3,Q4,AJA
0002                    NAM     BYR,CAE,DRY,EUC
0003        0004        MACH    4
0004  0000              REL     0
0005  0000  0001  Q2    DATA    Q22
0006  0001  000A  Q22   DATA    10,13
      0002  000D
0007  0003  D3C8        TEXT    'SHOW WHICH SPIES ARE IN'
      0004  CFD7
      0005  A0D7
      0006  C8C9
      0007  C3C8
      0008  A0D3
      0009  D0C9
      000A  C5D3
      000B  A0C1
      000C  D2C5
      000D  A0C9
      000E  CEA0
0008  000F  A0C5        TEXT    ' EACH COUNTRY'
      0010  C1C3
      0011  C8A0
      0012  C3CF
      0013  D5CE
      0014  D4D2
      0015  D9A0
0009  0016  000A        DATA    10,13,10
      0017  000D
      0018  000A
0010  0019  A8D0        TEXT    '(PRESS X WHEN READY FOR'
      001A  D2C5
      001B  D3D3
      001C  A0D8
      001D  A0D7
      001E  C8C5
      001F  CEA0
      0020  D2C5
      0021  C1C4
      0022  D9A0
      0023  C6CF
      0024  D2A0
0011  0025  A0CE        TEXT    ' NEXT COUNTRY)'
      0026  C5D8
      0027  D4A0
      0028  C3CF
      0029  D5CE
      002A  D4D2
      002B  D9A9
0012  002C  000A        DATA    10,13,10,10,10
      002D  000D
      002E  000A
      002F  000A
      0030  000A
```

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```
PAGE  0002

0013  0031  A0A0        TEXT    '      RURITANIA     0'
      0032  A0A0
      0033  A0A0
      0034  D2D5
      0035  D2C9
      0036  D4C1
      0037  CEC9
      0038  C1A0
      0039  A0A0
      003A  A0C0
0014  003B  003C  Q3      DATA    Q33
0015  003C  000A  Q33     DATA    10,13,10,10,10
      003D  000D
      003E  000A
      003F  000A
      0040  000A
0016  0041  A0A0        TEXT    '       OLYMPIA     0'
      0042  A0A0
      0043  A0A0
      0044  A0A0
      0045  CFCC
      0046  D9CD
      0047  D0C9
      0048  C1A0
      0049  A0A0
      004A  A0C0
0017  004B  004C  Q4      DATA    Q44
0018  004C  000A  Q44     DATA    10,13,10,10,10
      004D  000D
      004E  000A
      004F  000A
      0050  000A
0019  0051  A0A0        TEXT    '   TRANSYLVANIA    0'
      0052  A0D4
      0053  D2C1
      0054  CED3
      0055  D9CC
      0056  D6C1
      0057  CEC9
      0058  C1A0
      0059  A0A0
      005A  A0C0
0020  005B  005C  AJA     DATA    AAJ
0021  005C  C1CA  AAJ     TEXT    'AJAX  0'
      005D  C1D8
      005E  A0A0
      005F  C0A0
0022  0060  0061  BYR     DATA    RYB
0023  0061  C2D9  RYB     TEXT    'BYRON  0'
      0062  D2CF
      0063  CEA0
      0064  A0C0
0024  0065  0066  CAE     DATA    EAC
```

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```
PAGE  0
0025  0
      0
      0
      0
      0
0026  0
0027  0
      0
      0
      0
      0
0028  0
0029  0
      0
      0
      0
      0
0030
0000 ER

PAGE  0

      AAJ
      CUE
X     02
X     04

?
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PAGE  0003

0025  0066  C3C1  EAC     TEXT   'CAESAR  @'
      0067  C5D3
      0068  C1D2
      0069  A0A0
      006A  C0A0
0026  006B  006C  DRY     DATA   YRD
0027  006C  C4D2  YRD     TEXT   'DRYDEN  @'
      006D  D9C4
      006E  C5CE
      006F  A0A0
      0070  C0A0
0028  0071  0072  EUC     DATA   CUE
0029  0072  C5D5  CUE     TEXT   'EUCLID  @'
      0073  C3CC
      0074  C9C4
      0075  A0A0
      0076  C0A0
0030                    END
0000 ERRORS
```

```
PAGE  0004

     AAJ     005C  X   AJA     005B  X   BYR     0060  X   CAE     0065
     CUE     0072  X   DRY     006B      EAC     0066  X   EUC     0071
X    Q2      0000      Q22     0001  X   Q3      003B      Q33     003C
X    Q4      004B      Q44     004C      RYB     0061      YRD     006C
```

?

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PAGE  0001

0001                        NAM   SEG10,MAP2,X1,X2
0002                        NAM   GT,NUM1
0003                        NAM   Y1,Y2,CHEC
0004                        NAM   OUT1,APTR1,REP
0005        0004            MACH  4
0006  0000                  REL   0
0007  0000  0000  SEG10     NOP
0008  0001  B2F2            LDA   REP
0009  0002  F202            JMP   $+3
0010  0003  B2F1            LDA   STOR3
0011  0004  00D0            DAR
0012  0005  9AEF            STA   STOR3
0013  0006  2105            JAZ   V2
0014  0007  B2EE            LDA   STOR2
0015  0008  8AEE            ADD   STOR4
0016  0009  9AEC            STA   STOR2
0017  000A  F607            JMP   $-7
0018  000B  F900            JST   *ERAS
                  8177
0019  000C  B100  V2        LDA   APTR1     ANSW BUF START
                  0112
0020  000D  8AE8            ADD   STOR2     ADD AUGMENT FOR
0021  000E  9AE9            STA   APTR      REP NO
0022  000F  B100            LDA   *CFB
                  817B
0023  0010  9900            STA   *BUFAD
                  8179
0024  0011  F900            JST   *MAIN
                  8178
0025  0012  B100            LDA   *M        SCOR =
                  817C
0026  0013  0F00            SWM
0027  0014  F900            JST   *ODEC
                  817D
0028  0015  B100            LDA   *TX5
                  8184
0029  0016  9900            STA   *BUFAD
                  8179
0030  0017  F900            JST   *MAIN     QUESTION
                  8178
0031  0018  FA01            JST   MAP2      DISPLAAY
0032  0019  F23D            JMP   GO2
0033  001A  0800  MAP2      ENT
0034  001B  C61D            LAP   035       STPT
0035  001C  6D3B            WRA   :3B
0036  001D  B2C4            LDA   XP
0037  001E  9AC1            STA   XPTR
0038  001F  B2CA            LDA   YP
0039  0020  9AC0            STA   YPTR
0040  0021  B3BE  I1        LDA   *XPTR
0041  0022  E3BE            LDX   *YPTR     SPY NAME POINTS
0042  0023  F900            JST   *STPT
                  817E
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PAGE  0002

0043  0024  C61C            LAP   034
0044  0025  6D3B            WRA   :3B       SYMB
0045  0026  B2CB            LDA   CNT       8 POINTS
0046  0027  C000            CAI   0
0047  0028  F209            JMP   AJ
0048  0029  C001            CAI   1
0049  002A  F209            JMP   BY
0050  002B  C002            CAI   2
0051  002C  F209            JMP   CA
0052  002D  C003            CAI   3
0053  002E  F209            JMP   DR
0054  002F  C004            CAI   4
0055  0030  F209            JMP   EU
0056  0031  F214            JMP   FIN1
0057  0032  B100  AJ        LDA   *AJA
                  8185
0058  0033  F207            JMP   GO
0059  0034  B100  BY        LDA   *BYR
                  8186
0060  0035  F205            JMP   GO
0061  0036  B100  CA        LDA   *CAE
                  8187
0062  0037  F203            JMP   GO
0063  0038  B100  DR        LDA   *DRY
                  8188
0064  0039  F201            JMP   GO
0065  003A  B100  EU        LDA   *EUC
                  8189
0066  003B  9900  GO        STA   *BUFAD
                  8179
0067  003C  F900            JST   *MAIN
                  8178
0068  003D  DAA2            IMS   XPTR
0069  003E  DAA2            IMS   YPTR
0070  003F  DAB2            IMS   CNT
0071  0040  C61D            LAP   035
0072  0041  6D3B            WRA   :3B
0073  0042  F621            JMP   I1
0074  0043  DAAE  FIN2      IMS   CNT
0075  0044  DA9B            IMS   XPTR
0076  0045  DA9B            IMS   YPTR      BORDERS
0077  0046  C61D  FIN1      LAP   035
0078  0047  6D3B            WRA   :3B
0079  0048  B397            LDA   *XPTR
0080  0049  E397            LDX   *YPTR
0081  004A  F900            JST   *STPT
                  817E
0082  004B  C61E            LAP   :1E
0083  004C  6D3B            WRA   :3B       L VEC
0084  004D  0350            ARP             FOR
0085  004E  9900            STA   *DASH     DASHES
                  817F
0086  004F  0110            ZAR
```

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AD-A050 460 SYSTEM RESEARCH LTD RICHMOND (ENGLAND) F/G 5/10
THE INFLUENCE OF LEARNING STRATEGY AND PERFORMANCE STRATEGY UPO--ETC(U)
NOV 76 R BAILEY, D ENSOR, G PASK, T WATTS F44620-76-C-0003
UNCLASSIFIED AFOSR-TR-78-0134 NL

2 OF 2
AD
A050460

END
DATE
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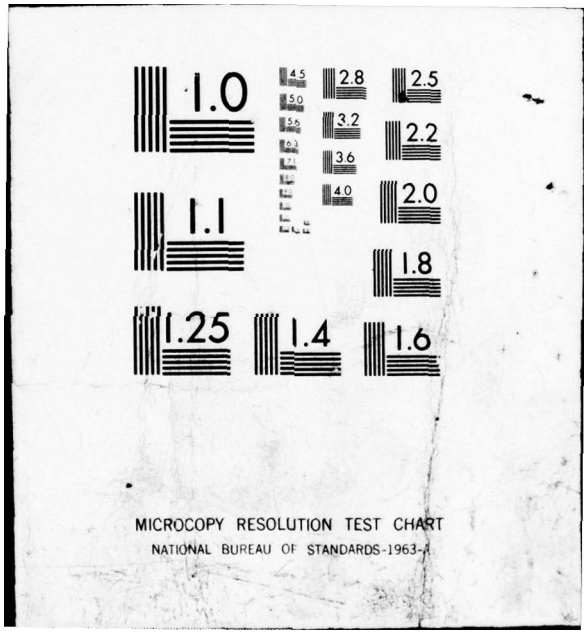
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1.1
1.25
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3.2
3.6
4.0
4.5
5.0
5.6
6.3
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

```
0087 0050 E2A2       LDX   H5
0088 0051 F900       JST   *LVCT
          8180
0089 0052 B29F       LDA   CNT
0090 0053 C006       CAI   6
0091 0054 F201       JMP   $+2       FINISH
0092 0055 F612       JMP   FIN2
0093 0056 F73C       RTN   MAP2
0094 0057 0110 GO2   ZAR
0095 0058 9A99       STA   CNT
0096 0059 C61C       LAP   034
0097 005A 6D3B       WRA   :3B
0098 005B C612       LAP   022
0099 005C 6D3B       WRA   :3B       DIS EKO
0100 005D F900 GO3   JST   *IKB      GET CHT
          818A
0101 005E C0D8       CAI   'X'
0102 005F F266       JMP   CHEC      FINISH
0103 0060 C0C1       CAI   'A'
0104 0061 F209       JMP   VALI
0105 0062 C0C2       CAI   'B'
0106 0063 F207       JMP   VALI
0107 0064 C0C3       CAI   'C'
0108 0065 F205       JMP   VALI
0109 0066 C0C4       CAI   'D'
0110 0067 F203       JMP   VALI
0111 0068 C0C5       CAI   'E'
0112 0069 F201       JMP   VALI
0113 006A F60D       JMP   GO3       INVALID
0114 006B 9B8C VALI  STA   *APTR
0115 006C DA8E       IMS   NUM2      PAIR DETECTOR
0116 006D B28D       LDA   NUM2
0117 006E C002       CAI   2
0118 006F F202       JMP   $+3       PAIR
0119 0070 DA87       IMS   APTR
0120 0071 F614       JMP   GO3       NEX
0121 0072 DA86       IMS   CNT1      8PAIR
0122 0073 0110       ZAR
0123 0074 9A86       STA   NUM2      RESET P D
0124 0075 B382       LDA   *APTR
0125 0076 FA01       JST   GT        GET COORDS
0126 0077 F219       JMP   GU
0127 0078 0800 GT    ENT
0128 0079 C0C1       CAI   'A'
0129 007A F20D       JMP   GT2
0130 007B DA7E       IMS   NUM1      BUMP POINT
0131 007C C0C2       CAI   'B'
0132 007D F20A       JMP   GT2
0133 007E DA7B       IMS   NUM1
0134 007F C0C3       CAI   'C'
0135 0080 F207       JMP   GT2
0136 0081 DA78       IMS   NUM1
0137 0082 C0C4       CAI   'D'
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0138 0083 F204       JMP   GT2
0139 0084 DA75       IMS   NUM1
0140 0085 C0C5       CAI   'E'
0141 0086 F201       JMP   GT2
0142 0087 DA72       IMS   NUM1
0143 0088 B27D GT2   LDA   CPTR
0144 0089 8A70       ADD   NUM1
0145 008A 9A71       STA   CPTR1
0146 008B B280       LDA   YCPT
0147 008C 8A6D       ADD   NUM1
0148 008D 9A6F       STA   YCPT1
0149 008E B36D       LDA   *CPTR1
0150 008F E36D       LDX   *YCPT1
0151 0090 F718       RTN   GT
0152 0091 9A6D GU    STA   X2
0153 0092 EA6E       STX   Y2        STOR CORDS
0154 0093 B264       LDA   APTR
0155 0094 00D0       DAR
0156 0095 9A62       STA   APTR
0157 0096 0110       ZAR
0158 0097 9A62       STA   NUM1
0159 0098 B35F       LDA   *APTR     GET SENDER
0160 0099 DA5E       IMS   APTR      RESET BUF
0161 009A FE22       JST   GT
0162 009B 9A62       STA   X1
0163 009C EA63       STX   Y1        STOR CORDS
0164 009D 0110       ZAR
0165 009E 9A5B       STA   NUM1
0166 009F C61D       LAP   035
0167 00A0 6D3B       WRA   :3B
0168 00A1 B25C       LDA   X1
0169 00A2 FBDB       JST   *STPT     POSITION BEAM
0170 00A3 B354       LDA   *APTR     GET NAMES AGIN
0171 00A4 E253       LDX   APTR
0172 00A5 00A8       DXR
0173 00A6 EA51       STX   APTR
0174 00A7 E350       LDX   *APTR
0175 00A8 DA4F       IMS   APTR
0176 00A9 C0C1       CAI   'A'       SEE WHETHER
0177 00AA F203       JMP   BA        BEAM NEEDS
0178 00AB C0C3       CAI   'C'
0179 00AC F204       JMP   DC        TO BE OFSET
0180 00AD F20D       JMP   OUT
0181 00AE C1C2 BA    CXI   'B'
0182 00AF F204       JMP   SHIFL     LEFT
0183 00B0 F20A       JMP   OUT       NO
0184 00B1 C1C4 DC    CXI   'D'
0185 00B2 F205       JMP   SHIFR     RIGHT
0186 00B3 F207       JMP   OUT
0187 00B4 B24D SHIFL LDA   XSHL
0188 00B5 E24A       LDX   Y1
0189 00B6 FBC7       JST   *STPT
0190 00B7 F203       JMP   OUT
```

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PAGE  0005

0191  00B8  B24A  SHIFR  LDA    XSHR
0192  00B9  E246        LDX    Y1
0193  00BA  FBC3        JST    *STPT
0194  00BB  F3C5  OUT   JMP    *SEG11   VEC CALC
0195  00BC  0000  OUT1  NOP
0196  00BD  DA3A        IMS    APTR
0197  00BE  B23A        LDA    CNT1
0198  00BF  C010        CAI    16       16 PAIR?
0199  00C0  F201        JMP    CON
0200  00C1  F664        JMP    GO3      NEX PAIR
0201  00C2  C608  CON   LAP    8        CONFIDEN
0202  00C3  FBB6        JST    *WATE1
0203  00C4  0000        NOP
0204  00C5  0000        NOP
0205  00C6  0110  CHEC  ZAR
0206  00C7  9A31        STA    CNT1
0207  00C8  FBAE        JST    *ERAS
0208  00C9  FBC2        JST    *SEG4
0209  00CA  B239        LDA    FS
0210  00CB  9B2C        STA    *APTR    END MARK
0211  00CC  DA2B        IMS    APTR
0212  00CD  B3BF        LDA    *CONF    CONFID MARK
0213  00CE  9B29        STA    *APTR    STORFD
0214  00CF  DA28        IMS    APTR
0215  00D0  B223        LDA    REP      REPEAT NO
0216  00D1  9B26        STA    *APTR    STORED
0217  00D2  FB88        JST    *CHEX    CHK PREDICTION
0218  00D3  C001        CAI    1        IF A = 1
0219  00D4  F3AD        JMP    *SEG12   NEX QUESTION
0220  00D5  DA1E        IMS    REP      BUMP REPT NO
0221  00D6  B3B7        LDA    *TX6     TRY AGAIN
0222  00D7  9BA1        STA    *BUFAD
0223  00D8  FB9F        JST    *MAIN
0224  00D9  B22B        LDA    DT1
0225  00DA  FB9F        JST    *WATE1
0226  00DB  FBA7        JST    *MENU
0227  00DC  0805        STOP   5
0228  00DD  0110        ZAR
0229  00DE  9A13        STA    CNT
0230  00DF  F6DF        JMP    SEG10    NEX TRY
0231  00E0  0000  XPTR  DATA   0
0232  00E1  0000  YPTR  DATA   0
0233  00E2  00E3  XP    DATA   PX
0234  00E3  FF1A  PX    DATA   -230,-240,155,155,30
      00E4  FF10
      00E5  009B
      00E6  009B
      00E7  001E
0235  00E8  FF7E        DATA   -130,115
      00E9  0073
0236  00EA  00EB  YP    DATA   PY
0237  00EB  0082  PY    DATA   130,-330,130,-330,-100
      00EC  FEB6

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PAGE  0006

      00ED  0082
      00EE  FEB6
      00EF  FF9C
0238  00F0  0118        DATA   280,280
      00F1  0118
0239  00F2  0000  CNT   DATA   0
0240  00F3  FD44  H5    DATA   -700
0241  00F4  0000  REP   DATA   0
0242  00F5  0000  STOR3 DATA   0
0243  00F6  0000  STOR2 DATA   0
0244  00F7  0014  STOR4 DATA   20
0245  00F8  0000  APTR  DATA   0
0246  00F9  0000  CNT1  DATA   0
0247  00FA  0000  NUM1  DATA   0
0248  00FB  0000  NUM2  DATA   0
0249  00FC  0000  CPTR1 DATA   0
0250  00FD  0000  YCPT1 DATA   0
0251  00FE  0000  X1    DATA   0
0252  00FF  0000  X2    DATA   0
0253  0100  0000  Y1    DATA   0
0254  0101  0000  Y2    DATA   0
0255  0102  FF10  XSHL  DATA   -240
0256  0103  00F0  XSHR  DATA   240
0257  0104  FFFF  FS    DATA   :FFFF
0258  0105  0032  DT1   DATA   50
0259  0106  0107  CPTR  DATA   CR
0260  0107  FF38  CR    DATA   -200,-200,200,200,0
      0108  FF38
      0109  00C8
      010A  00C8
      010B  0000
0261  010C  010D  YCPT  DATA   CP
0262  010D  0064  CP    DATA   100,-300,100,-300,-100
      010E  FED4
      010F  0064
      0110  FED4
      0111  FF9C
0263  0112  0113  APTR1 DATA   AR1
0264  0113        AR1   RES    100
0265  0177        ERAS  REF
0266  0178        MAIN  REF
0267  0179        BUFAD REF
0268  017A        WATE1 REF
0269  017B        CFB   REF
0270  017C        M     REF
0271  017D        ODEC  REF
0272  017E        STPT  REF
0273  017F        DASH  REF
0274  0180        LVCT  REF
0275  0181        SEG11 REF
0276  0182        SEG12 REF
0277  0183        MENU  REF
0278  0184        TX5   REF

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PAGE  0007

0279  0185        AJA     REF
0280  0186        BYR     REF
0281  0187        CAE     REF
0282  0188        DRY     REF
0283  0189        EUC     REF
0284  018A        IKB     REF
0285  018B        CHEX    REF
0286  018C        SEG4    REF
0287  018D        CONF    REF
0288  018E        TX6     REF
0289                      END
0000 ERRORS
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PAGE  0008

    AJA     0185      AJ      0032
?
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```
0001  NAM TX5,TX6
0002  MACH 4
0003  REL 0
0004 TX5 DATA XT5
0005 XT5 DATA 10,13
0006  TEXT 'SPIES STAYED IN SAME COUNTRIES IN 1981.'
0007  DATA 10,13
0008  TEXT 'PRESS PAIRS OF INITIALS (SENDER FIRST)'
0009  DATA 10,13
0010  TEXT 'TO SHOW WHAT POSSIBLE MESSAGE PATHS YOU'
0011  DATA 10,13
0012  TEXT 'THINK THERE WERE IN 1981.'
0013  DATA 10,13,10
0014  TEXT 'PRESS X WHEN YOU HAVE FINISHED.'
0015  DATA 10,13,10,13,10,13,10,13
0016  DATA 10,13,10,13
0017  TEXT 'RURITANIA          OLYMPIA          '
0018  TEXT 'TRANSYLVANIA@'
0019 TX6 DATA XT6
0020 XT6 TEXT 'HAVE ANOTHER TRY AFTER YOU '
0021  DATA 10,13
0022  TEXT 'HAVE BEEN OFFERED INFORMATION@'
0023  END

?D1 23/←
?
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```
0001                        NAM   SEG11
0002                        NAM   S11A,FLAG
0003        0004            MACH  4
0004  0000                  REL   0
0005  0000  0800  S11A      ENT
0006  0001  0000  SEG11     NOP
0007  0002  FA01            JST   S11
0008  0003  F22D            JMP   GO2
0009  0004  0800  S11       ENT
0010  0005  B3BB            LDA   *X1
0011  0006  2117            JAZ   SAM1      SAME SIDE OF 0
0012  0007  218A            JAL   LS        LESS
0013  0008  B3B9  MR        LDA   *X2
0014  0009  211F            JAZ   SAM4
0015  000A  31A3            JAG   SAM5
0016  000B  0210  OPP       CAR             MAK X2 POZ
0017  000C  0150            IAR             X1 IS ALRDY
0018  000D  8BB3            ADD   *X1       MAK CORD
0019  000E  0210            CAR
0020  000F  0150            IAR             CHNG SGN
0021  0010  9A77            STA   XS
0022  0011  F21E            JMP   GO
0023  0012  B3AF  LS        LDA   *X2
0024  0013  210D            JAZ   SAM2
0025  0014  3181            JAG   OPP1      X2 >0
0026  0015  F210            JMP   SAM3
0027  0016  0000  OPP1      NOP
0028  0017  E3A9            LDX   *X1       MAK X1 POZ
0029  0018  0408            CXR
0030  0019  0128            IXR
0031  001A  EA6D            STX   XS
0032  001B  8A6C            ADD   XS
0033  001C  9A68            STA   XS
0034  001D  F212            JMP   GO
0035  001E  B3A3  SAM1      LDA   *X2       X1 =0 GET X2
0036  001F  9A68            STA   XS
0037  0020  F20F            JMP   GO
0038  0021  E39F  SAM2      LDX   *X1
0039  0022  0408            CXR
0040  0023  0128            IXR
0041  0024  EA63            STX   XS
0042  0025  F20A            JMP   GO
0043  0026  939A  SAM3      SUB   *X1
0044  0027  9A60            STA   XS        BOTH NEG
0045  0028  F207            JMP   GO        SGN OK
0046  0029  B397  SAM4      LDA   *X1
0047  002A  0210            CAR             X1 + X2 0
0048  002B  0150            IAR
0049  002C  9A5B            STA   XS        NEGATE X1
0050  002D  F202            JMP   GO
0051  002E  9392  SAM5      SUB   *X1       A=X2 BOTH POZ
0052  002F  9A58            STA   XS        SGN OK.
0053  0030  F72C  GO        RTN   S11
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```
0054  0031  B256  GO2       LDA   XS
0055  0032  10D0            ARA   1         DVD BY 2
0056  0033  9A55            STA   XC        STOR
0057  0034  B38F            LDA   *Y2
0058  0035  9B8C            STA   *X2
0059  0036  B38C            LDA   *Y1
0060  0037  9B89            STA   *X1
0061  0038  FE34            JST   S11
0062  0039  B24E            LDA   XS        Y VALUE
0063  003A  10D0            ARA   1         DVD BY 2
0064  003B  9A4E            STA   YC        STOR
0065  003C  C61D            LAP   035
0066  003D  6D3B            WRA   :3B       L. V.
0067  003E  0110            ZAR
0068  003F  9B87            STA   *DASH
0069  0040  B248            LDA   XC
0070  0041  E248            LDX   YC        GET COORDS
0071  0042  FB82            JST   *LVCT
0072  0043  0110            ZAR
0073  0044  9A46            STA   NUM3      HALF LINE
0074  0045  B243            LDA   XC        DONE SO CHOOS ARROW
0075  0046  3105            JAN   NZ
0076  0047  B242            LDA   YC
0077  0048  2181            JAL   YNEG
0078  0049  F211            JMP   GTIT      GET ARROW CORDS
0079  004A  DA40  YNEG      IMS   NUM3
0080  004B  F20F            JMP   GTIT
0081  004C  B23C  NZ        LDA   XC
0082  004D  2087            JAM   AMIN      X NEG
0083  004E  C602            LAP   2
0084  004F  9A3B            STA   NUM3
0085  0050  B239  XPL       LDA   YC
0086  0051  2109            JAZ   GTIT
0087  0052  DA38            IMS   NUM3
0088  0053  21C9            JAL   YNEG      (4)
0089  0054  F206            JMP   GTIT
0090  0055  C605  AMIN      LAP   5
0091  0056  9A34            STA   NUM3
0092  0057  B232            LDA   YC
0093  0058  2102            JAZ   GTIT
0094  0059  DA31            IMS   NUM3
0095  005A  21D0            JAL   YNEG
0096  005B  B232  GTIT      LDA   XARPT
0097  005C  9A30            STA   XARP1
0098  005D  B24A            LDA   YARPT
0099  005E  9A48            STA   YARP1
0100  005F  0110            ZAR
0101  0060  9A2B            STA   NUM4
0102  0061  B229            LDA   NUM3
0103  0062  2108            JAZ   GT1
0104  0063  00D0            DAR
0105  0064  9A26            STA   NUM3
0106  0065  C603            LAP   3
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0107  0066  8A25        ADD   NUM4
0108  0067  9A24        STA   NUM4
0109  0068  B222        LDA   NUM3
0110  0069  2101        JAZ   GT1
0111  006A  F607        JMP   $-7
0112  006B  B221  GT1   LDA   XARP1
0113  006C  8A1F        ADD   NUM4
0114  006D  9A1F        STA   XARP1
0115  006E  B238        LDA   YARP1
0116  006F  8A1C        ADD   NUM4
0117  0070  9A36        STA   YARP1
0118  0071  0110        ZAR
0119  0072  9A19        STA   NUM4
0120  0073  FA01        JST   GT2
0121  0074  F205        JMP   GT3
0122  0075  0800  GT2   ENT
0123  0076  B316        LDA   *XARP1
0124  0077  E32F        LDX   *YARP1
0125  0078  FB4C        JST   *LVCT
0126  0079  F704        RTN   GT2
0127  007A  DA12  GT3   IMS   XARP1
0128  007B  DA2B        IMS   YARP1
0129  007C  FE07        JST   GT2
0130  007D  DA0F        IMS   XARP1
0131  007E  DA28        IMS   YARP1
0132  007F  FE0A        JST   GT2
0133  0080  B208        LDA   XC      ARROW DONE
0134  0081  E208        LDX   YC      2ND HALF
0135  0082  FB42        JST   *LVCT
0136  0083  B203        LDA   FLAG
0137  0084  C0FF        CAI   :FF
0138  0085  F785        RTN   S11A
0139  0086  F33F        JMP   *OUT1   BAC TO SEG10
0140  0087  0000  FLAG  DATA  0
0141  0088  0000  XS    DATA  0
0142  0089  0000  XC    DATA  0
0143  008A  0000  YC    DATA  0
0144  008B  0000  NUM3  DATA  0
0145  008C  0000  NUM4  DATA  0
0146  008D  0000  XARP1 DATA  0
0147  008E  008F  XARPT DATA  ARP
0148  008F  FFF6  ARP   DATA  -10,20,-10,-10,20,-10
      0090  0014
      0091  FFF6
      0092  FFF6
      0093  0014
      0094  FFF6
0149  0095  FFF6        DATA  -10,0,10,-10,10,0
      0096  0000
      0097  000A
      0098  FFF6
      0099  000A
      009A  0000
```

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PAGE  0004

0150  009B  0000        DATA  0,-10,10,10,0,-10
      009C  FFF6
      009D  000A
      009E  000A
      009F  0000
      00A0  FFF6
0151  00A1  0000        DATA  0,10,-10,0,10,-10
      00A2  000A
      00A3  FFF6
      00A4  0000
      00A5  000A
      00A6  FFF6
0152  00A7  0000  YARP1 DATA  0
0153  00A8  00A9  YARPT DATA  YARP
0154  00A9  FFF6  YARP  DATA  -10,0,10,10,0,-10
      00AA  0000
      00AB  000A
      00AC  000A
      00AD  0000
      00AE  FFF6
0155  00AF  000A        DATA  10,-20,10,0,-10,10
      00B0  FFEC
      00B1  000A
      00B2  0000
      00B3  FFF6
      00B4  000A
0156  00B5  000A        DATA  10,-10,0,10,-20,10
      00B6  FFF6
      00B7  0000
      00B8  000A
      00B9  FFEC
      00BA  000A
0157  00BB  FFF6        DATA  -10,10,0,10,-10,0
      00BC  000A
      00BD  0000
      00BE  000A
      00BF  FFF6
      00C0  0000
0158  00C1        X1    REF
0159  00C2        X2    REF
0160  00C3        Y1    REF
0161  00C4        Y2    REF
0162  00C5        LVCT  REF
0163  00C6        OUT1  REF
0164  00C7        DASH  REF
0165              END
0000 ERRORS
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 DI 165.
?XA.



PAGE  0001

0001                        NAM    SEG12,CHEX
0002          0004          MACH   4
0003  0000                  REL    0
0004  0000  0806  SEG12    STOP   6
0005  0001  0800  CHEX     ENT
0006  0002  0110          ZAR
0007  0003  F702          RTN    CHEX
0008                        END
0000 ERRORS



PAGE  0002

X   CHEX    0001  X   SEG12   0000


?
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```
PAGE  0001

0001                        NAM    SEG12,AAB12
0002                        NAM    XXX,TRP,ASLR
0003  0000          SORC    REF
0004  0001          X1      REF
0005  0002          X2      REF
0006  0003          Y1      REF
0007  0004          Y2      REF
0008  0005          ERAS    REF
0009  0006          AAFB    REF
0010  0007          CRLF    REF
0011  0008          014     REF
0012  0009          016     REF
0013  000A          TESIA   REF
0014  000B          BUFAD   REF
0015  000C          MAIN    REF
0016  000D          012     REF
0017  000E          IKB     REF
0018  000F          013     REF
0019  0010          E       REF
0020  0011          R       REF
0021  0012          SEG4    REF
0022  0013          H80     REF
0023  0014          RESP    REF
0024  0015          RITE    REF
0025  0016          CONF    REF
0026  0017          BG2     REF
0027  0018          CEIN    REF
0028  0019          MAP2    REF
0029  001A          GT      REF
0030  001B          NUMI    REF
0031  001C          STPT    REF
0032  001D          S11A    REF
0033  001E          FLAG    REF
0034  001F          NAMZ    REF
0035  0020          SEG13   REF
0036  0021          SEG14   REF
0037  0022  0800    S12     ENT
0038  0023  0000    SEG12   NOP
0039  0024  FF1F            JST    *ERAS
0040  0025  B718            LDA    *012
0041  0026  9F1B            STA    *BUFAD
0042  0027  FF1B            JST    *MAIN
0043  0028  FF1A    A12     JST    *IKB
0044  0029  C0A1            CAI    :A1      LISTS?
0045  002A  F203            JMP    B12
0046  002B  C0A2            CAI    :A2      NO GRAFS THEN?
0047  002C  F256            JMP    D12      YES
0048  002D  F605            JMP    $-5      INVALID
0049  002E  0000    B12     NOP
0050  002F  FF2A            JST    *ERAS
0051  0030  B721            LDA    *013     ASLEAANED OR REPRES
0052  0031  9F26            STA    *BUFAD
0053  0032  FF26            JST    *MAIN
```

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PAGE  0002

0054  0033  FF25          JST   *IKB
0055  0034  C0A1          CAI   :A1      ASLEARN
0056  0035  F203          JMP   $+4      YES
0057  0036  C0A2          CAI   :A2      REPR?
0058  0037  F215          JMP   C12      YES
0059  0038  F605          JMP   $-5      INVALID
0060  0039  0350  B12A    ARP            AS LEARN
0061  003A  9F2A          STA   *E
0062  003B  FF36  B12B    JST   *ERAS
0063  003C  FF25          JST   *BG2
0064  003D  FF36          JST   *CRLF
0065  003E  FF37          JST   *CRLF
0066  003F  C6FF          LAP   :FF
0067  0040  9F2F          STA   *R
0068  0041  FF37          JST   *TES1A   DO TABLE
0069  0042  FF30          JST   *SEG4    CONF
0070  0043  FA31          JST   SCIT     STOR SCOR
0071  0044  DF34          IMS   *E
0072  0045  B735          LDA   *E
0073  0046  C007          CAI   7
0074  0047  F202          JMP   $+3      YES
0075  0048  FF43          JST   *ERAS
0076  0049  F60E          JMP   B12B     NO GOBAK
0077  004A  FF45          JST   *ERAS
0078  004B  DABA          IMS   STO1     LISTS DUN FLAG
0079  004C  F224          JMP   OWT      CHEK OTHER DUN
0080  004D  0350  C12     ARP
0081  004E  9F3E          STA   *E
0082  004F  FF4A  C13     JST   *ERAS
0083  0050  FF39          JST   *BG2
0084  0051  FF4A          JST   *CRLF
0085  0052  FF4B          JST   *CRLF
0086  0053  C6FE  C2      LAP   :FE
0087  0054  9F43          STA   *R       REPRESENTATIVE
0088  0055  FF4B          JST   *TES1A
0089  0056  B742          LDA   *RESP
0090  0057  C0D8          CAI   'X'      FINISHED?
0091  0058  F207          JMP   NEX2     YS NEX EPOK
0092  0059  9900          STA   *RPT     STOR
              81D6
0093  005A  D900          IMS   RPT
              01D6
0094  005B  DAAB          IMS   SIXT     60 MAX 15OF 4
0095  005C  B2AA          LDA   SIXT
0096  005D  C03D          CAI   :3D
0097  005E  F201          JMP   NEX2     >60
0098  005F  F60C          JMP   C2       NEXT CHT
0099  0060  B2A4  NEX2    LDA   FS,
0100  0061  9900          STA   *RPT
              81D6
0101  0062  D900          IMS   RPT
              01D6
0102  0063  0110          ZAR
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PAGE  0003

0103  0064  9F64          STA   *SORC
0104  0065  FF60          JST   *ERAS
0105  0066  FF54          JST   *SEG4
0106  0067  B751          LDA   *CONF
0107  0068  9900          STA   *RPT
              81D6
0108  0069  D900          IMS   RPT
              01D6
0109  006A  DF5A          IMS   *E
0110  006B  B75B          LDA   *E
0111  006C  C007          CAI   7
0112  006D  F201          JMP   $+2
0113  006E  F61F          JMP   C13      NEXT EPOK
0114  006F  DA96          IMS   STO1     LISTS DUN FLAG
0115  0070  F200          JMP   OWT      CHEK OTHER DUN
0116  0071  B294  OWT     LDA   STO1
0117  0072  C002          CAI   2        LISTS & GRAFS DUN?
0118  0073  F28A          JMP   END1     YES
0119  0074  F20E          JMP   D12      GRAFS YET
0120  0075  0800  SCIT    ENT
0121  0076  B766          LDA   *E
0122  0077  9900          STA   *ASLP    AS LEARNED ANSW BUF
              8369
0123  0078  D900          IMS   ASLP
              0369
0124  0079  0110          ZAR
0125  007A  9900          STA   *ASLP    REP NO ALWAYS 0
              8369
0126  007B  D900          IMS   ASLP
              0369
0127  007C  B767          LDA   *RITE
0128  007D  9900          STA   *ASLP
              8369
0129  007E  D900          IMS   ASLP     SCOR/32
              0369
0130  007F  B769          LDA   *CONF
0131  0080  9900          STA   *ASLP
              8369
0132  0081  D900          IMS   ASLP
              0369
0133  0082  F70D          RTN   SCIT
0134  0083  FF7E  D12     JST   *ERAS
0135  0084  B77C          LDA   *014
0136  0085  9F7A          STA   *BUFAD   ABS TRACT OR
0137  0086  FF7A          JST   *MAIN    MAPS?
0138  0087  0000          NOP
0139  0088  FF7A  D12A    JST   *IKB
0140  0089  C0A1          CAI   :A1      ABSTRACT?
0141  008A  F26C          JMP   AB12     YES
0142  008B  C0A2          CAI   :A2
0143  008C  F201          JMP   $+2
0144  008D  F605          JMP   D12A     INVALID
0145  008E  FF89  A12D    JST   *ERAS    NO, ERASE &
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0146  003F  C6FD        LAP   :FD       MAP
0147  0090  9F7F        STA   *R
0148  0091  FF79        JST   *CEIN
0149  0092  B78C        LDA   *AAFB
0150  0093  9F88        STA   *BUFAD    COUNTRY NAMES
0151  0094  FF88        JST   *MAIN
0152  0095  FF7C        JST   *MAP2     MAP
0153  0096  FF88  03    JST   *IKB
0154  0097  C0C1        CAI   'A'
0155  0098  F20B        JMP   VAL
0156  0099  C0C2        CAI   'B'
0157  009A  F209        JMP   VAL
0158  009B  C0C3        CAI   'C'
0159  009C  F207        JMP   VAL
0160  009D  C0C4        CAI   'D'
0161  009E  F205        JMP   VAL
0162  009F  C0C5        CAI   'E'
0163  00A0  F203        JMP   VAL
0164  00A1  C0D8        CAI   'X'
0165  00A2  F241        JMP   CHE
0166  00A3  F60D        JMP   03        INVALID
0167  00A4  0000  VAL   NOP
0168  00A5  9B66        STA   *RPTR     STOR RESPONS
0169  00A6  DA61        IMS   NUM2
0170  00A7  B260        LDA   NUM2      PAIR DETECT
0171  00A8  C002        CAI   2
0172  00A9  F202        JMP   $+3       PAIR
0173  00AA  DA61        IMS   RPTR
0174  00AB  F615        JMP   03
0175  00AC  0110        ZAR
0176  00AD  9A5A        STA   NUM2      RESET P D
0177  00AE  B35D        LDA   *RPTR
0178  00AF  FF95        JST   *GT       GET COORDS OF
0179  00B0  9FAE        STA   *X2
0180  00B1  EFAD        STX   *Y2
0181  00B2  B259        LDA   RPTR
0182  00B3  00D0        DAR
0183  00B4  9A57        STA   RPTR
0184  00B5  0110        ZAR
0185  00B6  9F9B        STA   *NUM1
0186  00B7  B354        LDA   *RPTR
0187  00B8  DA53        IMS   RPTR
0188  00B9  FF9F        JST   *GT       GET COORDS OF
0189  00BA  9FB9        STA   *X1
0190  00BB  EFB7        STX   *Y2
0191  00BC  0110        ZAR
0192  00BD  9FA2        STA   *NUM1
0193  00BE  C61D        LAP   035
0194  00BF  6D3B        WRA   :3B       SET P
0195  00C0  B7BF        LDA   *X1
0196  00C1  FFA5        JST   *STPT
0197  00C2  B349        LDA   *RPTR     GET NAMES
0198  00C3  E248        LDX   RPTR
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PAGE  0005

0199  00C4  00A8        DXR
0200  00C5  EA46        STX   RPTR
0201  00C6  E345        LDX   *RPTR
0202  00C7  DA44        IMS   RPTR
0203  00C8  C0C1        CAI   'A'
0204  00C9  F203        JMP   BA        BEAM OFSET
0205  00CA  C0C3        CAI   'C'
0206  00CB  F204        JMP   DC
0207  00CC  F20D        JMP   OUT
0208  00CD  C1C2  BA    CXI   'B'
0209  00CE  F204        JMP   SHIFL
0210  00CF  F20A        JMP   OUT
0211  00D0  C1C4  DC    CXI   'D'
0212  00D1  F205        JMP   SHIFR
0213  00D2  F207        JMP   OUT
0214  00D3  B235  SHIFL LDA   XSHL
0215  00D4  E7D1        LDX   *Y1
0216  00D5  FFB9        JST   *STPT
0217  00D6  F203        JMP   OUT
0218  00D7  B232  SHIFR LDA   XSHR
0219  00D8  E7D5        LDX   *Y1
0220  00D9  FFBD        JST   *STPT
0221  00DA  C6FF  OUT   LAP   :FF
0222  00DB  9FBD        STA   *FLAG
0223  00DC  FFBF        JST   *S11A     VECTOR CALC
0224  00DD  DA2E        IMS   RPTR
0225  00DE  DA2C        IMS   CNT1
0226  00DF  B22B        LDA   CNT1
0227  00E0  C010        CAI   16        16 PAIR
0228  00E1  F201        JMP   CON
0229  00E2  F64C        JMP   03        NEX PAIR
0230  00E3  0000  CON   NOP
0231  00E4  0110  CHE   ZAR
0232  00E5  9A25        STA   CNT1
0233  00E6  FFE1        JST   *ERAS
0234  00E7  FFD5        JST   *SEG4
0235  00E8  B31C        LDA   *FS
0236  00E9  9B22        STA   *RPTR     END MARK
0237  00EA  DA21        IMS   RPTR
0238  00EB  B7D5        LDA   *CONF
0239  00EC  9B1F        STA   *RPTR     CONF STORD
0240  00ED  DFDD        IMS   *E
0241  00EE  B7DE        LDA   *E
0242  00EF  C007        CAI   7
0243  00F0  F201        JMP   $+2       FINISH
0244  00F1  F663        JMP   A12D      NEX EPOK
0245  00F2  DA13        IMS   STO1
0246  00F3  B212        LDA   STO1
0247  00F4  C002        CAI   2
0248  00F5  F208        JMP   END1
0249  00F6  F6C8        JMP   B12       LIST YET
0250  00F7  0000  AB12  NOP
0251  00F8  F7D8        JMP   *SEG13
```

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0252  00F9  DA0C  AAB12  IMS   STO1
0253  00FA  B208         LDA   STO1
0254  00FB  C002         CAI   2
0255  00FC  F202         JMP   OVER     END OF ENTIRE TEST
0256  00FD  F6CF         JMP   B12
0257  00FE  F200  END1   JMP   OVER
0258  00FF  FFFA  OVER   JST   *ERAS
0259  0100  B7F7         LDA   *Q16
0260  0101  9FF6         STA   *BUFAD   END MASS
0261  0102  FFF6         JST   *MAIN
0262  0103  080F         STOP  :F
0263  0104  F7E3         JMP   *SEG14   SCORING
0264  0105  FFFF  FS     DATA  :FFFF
0265  0106  0000  STO1   DATA  0
0266  0107  0000  SIXT   DATA  0
0267  0108  0000  NUM2   DATA  0
0268  0109  FF10  XSHL   DATA  -240
0269  010A  00F0  XSHR   DATA  240
0270  010B  0000  CNT1   DATA  0
0271  010C  010E  RPTR   DATA  TRIP
0272  010D  010E  XXX    DATA  TRIP
0273  010E        TRIP   RES   200
0274  01D6  01D8  RPT    DATA  TPR
0275  01D7  01D8  TRP    DATA  TPR
0276  01D8        TPR    RES   400
0277  0368  036A  ASLR   DATA  SLP
0278  0369  036A  ASLP   DATA  SLP
0279  036A        SLP    RES   50
0280              END
0000 ERRORS


PAGE  0007

X   AAB12   00F9      AAFB    0006      AB12
?
```



```
PAGE  0001

0001                    NAM   SEG13
0002  0000        SEG4  REF
0003  0001        LVCT  REF
0004  0002        IKB   REF
0005  0003        ERAS  REF
0006  0004        R     REF
0007  0005        CEIN  REF
0008  0006        NAMZ  REF
0009  0007        Q15   REF
0010  0008        BUFAD REF
0011  0009        MAIN  REF
0012  000A        E     REF
0013  000B        STPT  REF
0014  000C        SEG14 REF
0015  000D        CONF  REF
0016  000E        AAB12 REF
0017  000F  0000  SEG13 NOP
0018  0010  FF0D        JST   *ERAS
0019  0011  0350        ARP
0020  0012  9F08        STA   *E
0021  0013  C6FD  BB13  LAP   :FD
0022  0014  9F10        STA   *R
0023  0015  FF10        JST   *CEIN
0024  0016  B70F        LDA   *Q15
0025  0017  9F0F        STA   *BUFAD
0026  0018  FF0F        JST   *MAIN
0027  0019  FF13        JST   *NAMZ
0028  001A  FA01  AA13  JST   A13
0029  001B  F210        JMP   C13
0030  001C  0800  A13   ENT
0031  001D  FF1B  B13   JST   *IKB
0032  001E  C0D8        CAI   'X'
0033  001F  F20B        JMP   VAL
0034  0020  C0C1        CAI   'A'
0035  0021  F209        JMP   VAL
0036  0022  C0C2        CAI   'B'
0037  0023  F207        JMP   VAL
0038  0024  C0C3        CAI   'C'
0039  0025  F205        JMP   VAL
0040  0026  C0C4        CAI   'D'
0041  0027  F203        JMP   VAL
0042  0028  C0C5        CAI   'E'
0043  0029  F201        JMP   VAL
0044  002A  F60D        JMP   B13      INVALID
0045  002B  F70F  VAL   RTN   A13
0046  002C  C0D8  C13   CAI   'X'
0047  002D  F247        JMP   OWTI
0048  002E  9900        STA   *ABPT
                821E
0049  002F  D900        IMS   ABPT
                021E
0050  0030  9A52        STA   SEND
0051  0031  FE15        JST   A13
```

```
0052 0032 C0D8          CAI   'X'
0053 0033 F602          JMP   $-2       2ND CANT BE END X
0054 0034 D24E          CMS   SEND
0055 0035 0000          NOP
0056 0036 F201          JMP   $+2
0057 0037 F606          JMP   $-6
0058 0038 9A4B          STA   RECE
0059 0039 9900          STA   *ABPT
          821E
0060 003A D900          IMS   ABPT
          021E
0061 003B B24F          LDA   XPRA
0062 003C 9A4D          STA   XABRP
0063 003D B100          LDA   YPRA
          0155
0064 003E 9900          STA   YABRP
          0154
0065 003F 0110          ZAR
0066 0040 9A46          STA   STOR2
0067 0041 B241          LDA   SEND
0068 0042 9242          SUB   COO
0069 0043 9900          STA   STOR1
          03AF
0070 0044 B100          LDA   STOR1
          03AF
0071 0045 00D0          DAR
0072 0046 9900          STA   STOR1
          03AF
0073 0047 2104          JAZ   GOT
0074 0048 C628          LAP   :28
0075 0049 8A3D          ADD   STOR2
0076 004A 9A3C          STA   STOR2
0077 004B F607          JMP   $-7
0078 004C B237    GOT   LDA   RECE
0079 004D D235          CMS   SEND
0080 004E F201          JMP   $+2
0081 004F 9100          SUB   WON
          03B0
0082 0050 0000          NOP
0083 0051 9233          SUB   COO
0084 0052 9900          STA   STOR1
          03AF
0085 0053 B100          LDA   STOR1
          03AF
0086 0054 00D0          DAR
0087 0055 9900          STA   STOR1
          03AF
0088 0056 2104          JAZ   GOT1
0089 0057 C60A          LAP   :A
0090 0058 8A2E          ADD   STOR2
0091 0059 9A2D          STA   STOR2
0092 005A F607          JMP   $-7
0093 005B B22E    GOT1  LDA   XABRP
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0094 005C 8A2A          ADD   STOR2
0095 005D 9A2C          STA   XABRP
0096 005E B2F5          LDA   YABRP
0097 005F 8A27          ADD   STOR2
0098 0060 9AF3          STA   YABRP
0099 0061 B328    LINZ  LDA   *XABRP
0100 0062 D223          CMS   TPN1
0101 0063 0000          NOP
0102 0064 F201          JMP   LINZ2
0103 0065 F204          JMP   LINZ3
0104 0066 D221    LINZ2 CMS   TPN2
0105 0067 0000          NOP
0106 0068 F208          JMP   DOVEC
0107 0069 F20A          JMP   FIN1
0108 006A DA1F    LINZ3 IMS   XABRP
0109 006B B31E          LDA   *XABRP
0110 006C E3E7          LDX   *YABRP
0111 006D FF62          JST   *STPT
0112 006E DA1B    LINZ4 IMS   XABRP
0113 006F DAE4          IMS   YABRP
0114 0070 F60F          JMP   LINZ
0115 0071 E3E2    DOVEC LDX   *YABRP
0116 0072 FF71          JST   *LVCT
0117 0073 F605          JMP   LINZ4
0118 0074 F65A    FIN1  JMP   AA13
0119 0075 B213    OWT1  LDA   FS
0120 0076 9900          STA   *ABPT
          821E
0121 0077 D900          IMS   ABPT
          021E
0122 0078 FF75          JST   *ERAS
0123 0079 FF79          JST   *SEG4
0124 007A B76D          LDA   *CONF
0125 007B 9900          STA   *ABPT
          821E
0126 007C D900          IMS   ABPT
          021E
0127 007D FF7A          JST   *ERAS
0128 007E DF74          IMS   *E
0129 007F B775          LDA   *E
0130 0080 C008          CAI   8
0131 0081 F773          JMP   *AAB12
0132 0082 F66F          JMP   BB13
0133 0083 0000    SEND  DATA  0
0134 0084 0000    RECE  DATA  0
0135 0085 00C0    COO   DATA  :C0
0136 0086 00C0    TPN1  DATA  192
0137 0087 0000    STOR2 DATA  0
0138 0088 FFFF    TPN2  DATA  :FFFF
0139 0089 FFFF    FS    DATA  :FFFF
```

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```
0140 XABRP DATA XARP
0141 XPRA DATA XARP
0142 XARP DATA 192,0,50,100,0,-10,10,100,0,:FFFF
0143  DATA 192,0,115,3,-10,7,115,0,0,:FFFF
0144  DATA 192,0,-100,7,-10,3,-100,0,0,:FFFF
0145  DATA 192,0,-112,0,10,-10,-113,0,0,:FFFF
0146  DATA 192,250,-50,-100,10,-10,0,-100,0,:FFFF
0147  DATA 192,250,10,-8,16,-8,-10,0,0,:FFFF
0148  DATA 192,250,-225,0,8,-8,-225,0,0,:FFFF
0149  DATA 192,250,-200,8,0,-8,-275,0,0,:FFFF
0150  DATA 192,230,-50,8,-16,8,-180,0,0,:FFFF
0151  DATA 192,230,-7,8,-16,8,-13,0,0,:FFFF
0152  DATA 192,230,-130,8,0,-8,-300,0,0,:FFFF
0153  DATA 192,230,-170,8,-8,0,-285,0,0,:FFFF
0154  DATA 192,-200,50,-8,16,-8,150,0,0,:FFFF
0155  DATA 192,-200,300,-8,8,0,150,0,0,:FFFF
0156  DATA 192,-200,50,150,-8,0,8,180,50,:FFFF
0157  DATA 192,-200,-10,-8,16,-8,-15,0,0,:FFFF
0158  DATA 192,-225,75,-8,8,0,150,0,0,:FFFF
0159  DATA 192,-225,125,-8,0,8,350,0,0,:FFFF
0160  DATA 192,-225,175,0,-8,8,275,0,0,:FFFF
0161  DATA 192,-225,15,8,-16,8,10,0,0,:FFFF
0162 YABRP DATA YARP
0163 YPRA DATA YARP
0164 YARP DATA 325,0,-112,10,-10,0,-113,-50,0,0
0165  DATA 325,-337,10,-3,-7,-338,0,0,0,0
0166  DATA 325,-337,5,3,-8,-338,0,0,0,0
0167  DATA 325,-137,10,-8,-2,-138,0,0,0,0
0168  DATA 50,0,112,0,-10,10,113,50,0,0
0169  DATA 50,-200,8,0,-8,-200,0,0,0,0
0170  DATA 50,-200,8,-8,0,-200,0,0,0,0
0171  DATA 50,0,8,-16,8,0,0,0,0,0
0172  DATA -350,150,-4,-4,8,525,0,0,0,0
0173  DATA -350,150,-8,0,8,250,0,0,0,0
0174  DATA -350,0,8,-16,8,0,0,0,0,0
0175  DATA -350,150,0,-8,8,250,0,0,0,0
0176  DATA -350,150,-4,-4,8,525,0,0,0,0
0177  DATA -350,260,0,-8,8,140,0,0,0,0
0178  DATA -350,-50,0,8,-16,8,0,50,0,0
0179  DATA -350,150,-8,0,8,250,0,0,0,0
0180  DATA 50,90,0,-8,8,185,0,0,0,0
0181  DATA 50,0,8,-16,8,0,0,0,0,0
0182  DATA 50,-150,8,-8,0,-250,0,0,0,0
0183  DATA 50,-150,8,0,-8,-250,0,0,0,0
0184 ABPT DATA TPBA
0185 TPBA RES 400
0186 STORI DATA 0
0187 WON DATA 1
0188  END
0189  NAM Q12,Q13,Q14
0190  NAM Q15,Q16,SEG14
0191  NAM AAFB
0192 Q12 DATA AQ12
```

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```
0193 AQ12 TEXT 'TRY TO RECALL ALL THE LISTS'
0194  DATA 10,13
0195  TEXT 'AND ALL NETWORKS FOR ALL YEARS'
0196  DATA 10,13,10,13
0197  TEXT 'WHICH WOULD YOU LIKE TO DO FIRST?'
0198  DATA 10,13,10,13
0199  TEXT 'LISTS - PRESS 1'
0200  DATA 10,13
0201  TEXT 'NETS  - PRESS 2@'
0202 Q13 DATA AQ13
0203 AQ13 TEXT 'WOULD YOU RATHER RECALL LISTS'
0204  DATA 10,13
0205  TEXT 'AS YOU LEARNED THEM OR AS'
0206  DATA 10,13
0207  TEXT 'REPRESENTATIVE SEQUENCES OF UP'
0208  DATA 10,13
0209  TEXT 'TO 15 LINES?'
0210  DATA 10,13,10,13
0211  TEXT 'AS LEARNED    - PRESS 1'
0212  DATA 10,13,10,13
0213  TEXT 'REPRESENTATIVE- PRESS 2@'
0214 Q14 DATA AQ14
0215 AQ14 TEXT 'WOULD YOU RATHER RECALL NETS AS'
0216  DATA 10,13
0217  TEXT 'ABSTRACT GRAPHS OR AS MAPS'
0218  DATA 10,13
0219  TEXT 'SHOWING COUNTRY BOUNDARIES?'
0220  DATA 10,13,10,13
0221  TEXT 'ABSTRACT - PRESS 1'
0222  DATA 10,13,10,13
0223  TEXT 'MAPS     -  PRESS 2@'
0224 Q15 DATA AQ15
0225 AQ15 DATA 10,13
0226  TEXT 'PRESS X WHEN FINISHED@'
0227 AAFB DATA BFA
0228 BFA DATA 10,13,10,13,10,13
0229  DATA 10,13,10,13,10,13
0230  TEXT 'RURITANIA          OLYMPIA     '
0231  TEXT '      TRANSYLVANIA@'
0232 Q16 DATA AQ16
0233 AQ16 TEXT 'END OF TEST   THANK YOU.@'.
0234  END

?
```

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```
PAGE  0001

0001                        NAM   MENU,PROJ
0002        0004            MACH  4
0003  0000                  REL   0
0004  0000  0001  MU        DATA  MENU
0005  0001  0800  MENU      ENT
0006  0002  0000  NU        NOP
0007  0003  F900            JST   *ERAS
                  815C
0008  0004  B100            LDA   *CFB
                  816F
0009  0005  9900            STA   *BUFAD
                  8167
0010  0006  F900            JST   *MAIN
                  8168
0011  0007  B100            LDA   *M
                  816C
0012  0008  0F00            SWM
0013  0009  F900            JST   *ODEC
                  8170
0014  000A  B100            LDA   *MN1
                  815D
0015  000B  9900            STA   *BUFAD
                  8167
0016  000C  F900            JST   *MAIN
                  8168
0017  000D  F900  NU1       JST   *IKB
                  8169
0018  000E  C0D8            CAI   'X'
0019  000F  F2DD            JMP   BAC
0020  0010  C0A1            CAI   :A1
0021  0011  F209            JMP   A1
0022  0012  C0A2            CAI   :A2
0023  0013  F21D            JMP   B1
0024  0014  C0A3            CAI   :A3
0025  0015  F254            JMP   C1
0026  0016  C0A4            CAI   :A4
0027  0017  F264            JMP   D1
0028  0018  C0A5            CAI   :A5
0029  0019  F274            JMP   E1
0030  001A  F60D            JMP   NU1       INVALID
0031  001B  F900  A1        JST   *ERAS
                  815C
0032  001C  B100            LDA   *MN2
                  815E
0033  001D  9900            STA   *BUFAD
                  8167
0034  001E  F900            JST   *MAIN
                  8168
0035  001F  FA01            JST   NU2
0036  0020  F20C            JMP   OKA1
0037  0021  0800  NU2       ENT
0038  0022  0000  NU2A      NOP
0039  0023  F900            JST.  *IKB
```

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```
PAGE  0002

                  8169
0040  0024  8100            AND   FE
                  0158
0041  0025  C001            CAI   1
0042  0026  F205            JMP   OKA
0043  0027  C002            CAI   2
0044  0028  F203            JMP   OKA
0045  0029  C003            CAI   3
0046  002A  F201            JMP   OKA
0047  002B  F609            JMP   NU2A      INVALID
0048  002C  F70B  OKA       RTN   NU2
0049  002D  C401  OKA1      LXP   1
0050  002E  E900            STX   INC
                  0159
0051  002F  FA1B            JST   OKB1
0052  0030  F27D            JMP   PREZ
0053  0031  F900  B1        JST   *ERAS
                  815C
0054  0032  B100            LDA   *MN3
                  815F
0055  0033  9900            STA   *BUFAD
                  8167
0056  0034  F900            JST   *MAIN
                  8168
0057  0035  C604  NU3       LAP   4
0058  0036  9AB7            STA   SLID
0059  0037  9900            STA   INC
                  0159
0060  0038  FA01            JST   NU3A
0061  0039  F21A            JMP   PR1A
0062  003A  0800  NU3A      ENT
0063  003B  0000  NU3B      NOP
0064  003C  F900            JST   *IKB
                  8169
0065  003D  8100            AND   FE
                  0158
0066  003E  C001            CAI   1
0067  003F  F209            JMP   OKB
0068  0040  C002            CAI   2
0069  0041  F207            JMP   OKB
0070  0042  C003            CAI   3
0071  0043  F205            JMP   OKB
0072  0044  C004            CAI   4
0073  0045  F203            JMP   OKB
0074  0046  C005            CAI   5
0075  0047  F201            JMP   OKB
0076  0048  F60D            JMP   NU3B
0077  0049  FA01  OKB       JST   OKB1
0078  004A  F710            RTN   NU3A
0079  004B  0800  OKB1      ENT
0080  004C  0048            TAX
0081  004D  00A8            DXR
0082  004E  2804            JXZ   PR1
```

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```
PAGE  0003

0083  004F  B100          LDA   INC
                0159
0084  0050  3A9D          ADD   SLID
0085  0051  9A9C          STA   SLID
0086  0052  F604          JMP   $-4
0087  0053  F708    PR1   RTN   OKB1
0088  0054  F900    PR1A  JST   *ERAS
                815C
0089  0055  B100          LDA   *MN4
                8160
0090  0056  9900          STA   *BUFAD
                8167
0091  0057  F900          JST   *MAIN
                8168
0092  0058  0528          XRP
0093  0059  EAFF          STX   INC
0094  005A  FA01          JST   PR2
0095  005B  F252          JMP   PREZ
0096  005C  0800    PR2   ENT
0097  005D  F900    PR3   JST   *IKB
                8169
0098  005E  82F9          AND   FE
0099  005F  C001          CAI   1
0100  0060  F207          JMP   OKC
0101  0061  C002          CAI   2
0102  0062  F205          JMP   OKC
0103  0063  C003          CAI   3
0104  0064  F203          JMP   OKC
0105  0065  C004          CAI   4
0106  0066  F201          JMP   OKC
0107  0067  F60A          JMP   PR3
0108  0068  FE1D    OKC   JST   OKB1
0109  0069  F70D          RTN   PR2
0110  006A  C618    C1    LAP   24
0111  006B  9A82          STA   SLID
0112  006C  FBEF          JST   *ERAS
0113  006D  B3F3          LDA   *MN5
0114  006E  9BF8          STA   *BUFAD
0115  006F  FBF8          JST   *MAIN
0116  0070  C603          LAP   3
0117  0071  9AE7          STA   INC
0118  0072  FE51          JST   NU2
0119  0073  FE28          JST   OKB1
0120  0074  FBE7          JST   *ERAS
0121  0075  B3EC          LDA   *MN6
0122  0076  9BF0          STA   *BUFAD
0123  0077  FBF0          JST   *MAIN
0124  0078  0350          ARP
0125  0079  9ADF          STA   INC
0126  007A  FE40          JST   NU3A
0127  007B  F232          JMP   PREZ
0128  007C  C627    D1    LAP   39
0129  007D  9A70          STA   SLID
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PAGE  0004

0130  007E  FBDD          JST   *ERAS
0131  007F  B3E3          LDA   *MN7
0132  0080  9BE6          STA   *BUFAD
0133  0081  FBE6          JST   *MAIN
0134  0082  C605          LAP   5
0135  0083  9AD5          STA   INC
0136  0084  FE63          JST   NU2
0137  0085  FE3A          JST   OKB1
0138  0086  FBD5          JST   *ERAS
0139  0087  B3DC          LDA   *MN8
0140  0088  9BDE          STA   *BUFAD
0141  0089  FBDE          JST   *MAIN
0142  008A  0350          ARP
0143  008B  9ACD          STA   INC
0144  008C  FE52          JST   NU3A
0145  008D  F220          JMP   PREZ
0146  008E  C635    E1    LAP   53
0147  008F  9A5E          STA   SLID
0148  0090  FBCB          JST   *ERAS
0149  0091  B3D3          LDA   *MN9
0150  0092  9BD4          STA   *BUFAD
0151  0093  FBD4          JST   *MAIN
0152  0094  FBD4          JST   *IKB
0153  0095  82C2          AND   FE
0154  0096  C001          CAI   1
0155  0097  F203          JMP   OKE
0156  0098  C002          CAI   2
0157  0099  F201          JMP   OKE
0158  009A  F203          JMP   OKF
0159  009B  8A52    OKE   ADD   SLID
0160  009C  9A51          STA   SLID
0161  009D  F210          JMP   PREZ
0162  009E  C442    OKF   LXP   66
0163  009F  EA4E          STX   SLID
0164  00A0  00D0          DAR
0165  00A1  00D0          DAR
0166  00A2  C403          LXP   3
0167  00A3  EAB5          STX   INC
0168  00A4  FE59          JST   OKB1
0169  00A5  FBB6          JST   *ERAS
0170  00A6  B3BF          LDA   *MN10
0171  00A7  9BBF          STA   *BUFAD
0172  00A8  FBBF          JST   *MAIN
0173  00A9  0350          ARP
0174  00AA  9AAE          STA   INC
0175  00AB  FE8A          JST   NU2
0176  00AC  FE61          JST   OKB1
0177  00AD  FBAE          JST   *ERAS
0178  00AE  F21C    PREZ  JMP   PZ2
0179  00AF  D23E          CMS   SLID
0180  00B0  F21A          JMP   PZ2
0181  00B1  F201          JMP   $+2
0182  00B2  F218          JMP   PZ2
```

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PAGE  0005

0183  00B3  C63B        LAP    59
0184  00B4  D239        CMS    SLID
0185  00B5  F202        JMP    $+3
0186  00B6  0000        NOP
0187  00B7  F207        JMP    PZ3
0188  00B8  B235  GRAF  LDA    SLID
0189  00B9  92A0        SUB    A53
0190  00BA  9BAF        STA    *E
0191  00BB  C6FF        LAP    :FF
0192  00BC  9BAE        STA    *R
0193  00BD  FBB0        JST    *CEIN
0194  00BE  F225        JMP    SCOR
0195  00BF  C640  PZ3   LAP    64
0196  00C0  D22D        CMS    SLID
0197  00C1  F202        JMP    $+3
0198  00C2  0000        NOP
0199  00C3  F207        JMP    PZ2
0200  00C4  B229  LIST  LDA    SLID
0201  00C5  9295        SUB    A58
0202  00C6  9BA3        STA    *E
0203  00C7  C6FF        LAP    :FF
0204  00C8  9BA2        STA    *R
0205  00C9  FBA3        JST    *BEIN
0206  00CA  F219        JMP    SCOR
0207  00CB  FA01  PZ2   JST    PROJ
0208  00CC  F217        JMP    SCOR
0209  00CD  0800  PROJ  ENT
0210  00CE  40C3        SEL    :18,3
0211  00CF  C608        LAP    8
0212  00D0  6CC2        OTA    :18,2
0213  00D1  49C2        SEN    :18,2
0214  00D2  F601        JMP    $-1
0215  00D3  E21A        LDX    SLID
0216  00D4  1023        ALX    1
0217  00D5  0110        ZAR
0218  00D6  1970        DVD    TEN
      00D7  00EF
0219  00D8  102B        ALX    4
0220  00D9  0610        NRA
0221  00DA  0210        CAR
0222  00DB  6CC2        OTA    :18,2
0223  00DC  49C2        SEN    :18,2
0224  00DD  F601        JMP    $-1
0225  00DE  B278        LDA    DT1
0226  00DF  FB91        JST    *WATE1
0227  00E0  B20F        LDA    OI
0228  00E1  6CC2        OTA    :18,2
0229  00E2  49C2        SEN    :18,2
0230  00E3  F716        RTN    PROJ
0231  00E4  B20D  SCOR  LDA    SCPT
0232  00E5  8A08        ADD    SLID
0233  00E6  9A0A        STA    SCPTR
0234  00E7  B384        LDA    *M
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0235  00E8  9308        SUB    *SCPTR
0236  00E9  9B82        STA    *M
0237  00EA  0350        ARP
0238  00EB  9A02        STA    SLID
0239  00EC  F6EA        JMP    NU
0240  00ED  F7EC  BAC   RTN    MENU
0241  00EE  0001  SLID  DATA   1
0242  00EF  000A  TEN   DATA   10
0243  00F0  0100  OI    DATA   :100
0244  00F1  0000  SCPTR DATA   0
0245  00F2  00F3  SCPT  DATA   SC
0246  00F3  0001  SC    RES    100,1
0247  0157  0200  DT1   DATA   :200
0248  0158  0007  FE    DATA   7
0249  0159  0000  INC   DATA   0
0250  015A  0035  A53   DATA   53
0251  015B  003A  A58   DATA   58
0252  015C        ERAS  REF
0253  015D        MN1   REF
0254  015E        MN2   REF
0255  015F        MN3   REF
0256  0160        MN4   REF
0257  0161        MN5   REF
0258  0162        MN6   REF
0259  0163        MN7   REF
0260  0164        MN8   REF
0261  0165        MN9   REF
0262  0166        MN10  REF
0263  0167        BUFAD REF
0264  0168        MAIN  REF
0265  0169        IKB   REF
0266  016A        E     REF
0267  016B        R     REF
0268  016C        M     REF
0269  016D        BEIN  REF
0270  016E        CEIN  REF
0271  016F        CFB   REF
0272  0170        ODEC  REF
0273  0171        WATE1 REF
0274              END
0000 ERRORS
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0001  NAM MN1,MN2,MN3
0002  NAM MN4,MN5,MN6
0003  NAM MN7,MN8,MN9
0004  NAM MN10
0005  MACH 4
0006  REL 0
0007 MN1 DATA AMN
0008 AMN DATA 10,13
0009  TEXT 'INFORMATION COSTS YOU POINTS'
0010  DATA 10,13
0011  TEXT 'PRESS THE NUMBER OF YOUR CHOICE'
0012  DATA 10,13,10,13
0013  TEXT '(1)  LOGICAL RULES'
0014  DATA 10,13,10,13
0015  TEXT '(2)  ANY SPY'
0016  DATA 10,13,10,13
0017  TEXT '(3)  ANY YEAR'
0018  DATA 10,13,10,13
0019  TEXT '(4)  ANY LIST OR GRAPH'
0020  DATA 10,13,10,13
0021  TEXT '(5)  ANY COUNTRY'
0022  DATA 10,13,10,13
0023  TEXT '(X)  NO MORE INFORMATION REQUIRED@'
0024 MN2 DATA BMN
0025 BMN TEXT '(1)  RULES FOR BEING A SPY'
0026  DATA 10,13,10,13
0027  TEXT '(2)  RULES OF NETWORKS'
0028  DATA 10,13,10,13
0029  TEXT '(3)  HISTORICAL DEVELOPMENT RULES@'
0030 MN3 DATA CMN
0031 CMN TEXT '    WHICH SPY?'
0032  DATA 10,13,10,13,10,13
0033  TEXT '(1)  AJAX'
0034  DATA 10,13
0035  TEXT '(2)  BYRON'
0036  DATA 10,13
0037  TEXT '(3)  CAESAR'
0038  DATA 10,13
0039  TEXT '(4)  DRYDEN'
0040  DATA 10,13
0041  TEXT '(5)  EUCLID@'
0042 MN4 DATA DMN
0043 DMN TEXT '(1)  ROLE (ALL YEARS)'
0044  DATA 10,13,10,13
0045  TEXT '(2)  LOCATION'
0046  DATA 10,13,10,13
0047  TEXT '(3)  CONTACTS'
0048  DATA 10,13,10,13
0049  TEXT '(4)  TRANSACTIONS@'
0050 MN5 DATA EMN
0051 EMN TEXT '(1)  1976'
0052  DATA 10,13
0053  TEXT '(2)  1977'
0054  DATA 10,13
0055  TEXT '(3)  1978'
0056  DATA 10,13
0057  TEXT '(4)  1979'
0058  DATA 10,13
0059  TEXT '(5)  1980@'
0060 MN6 DATA FMN
0061 FMN TEXT 'FOR THE YEAR IN QUESTION WHICH DO YOU WANT?'
0062  DATA 10,13,10,13
0063  TEXT '(1)  THE MAP'
0064  DATA 10,13
0065  TEXT '(2)  THE GRAPH'
0066  DATA 10,13
0067  TEXT '(3)  THE LIST@'
0068 MN7 DATA GMN
0069 GMN TEXT 'WHICH OF THESE DO YOU WANT?'
0070  DATA 10,13,10,13
0071  TEXT '(1)  GRAPHS WITH BORDERS'
0072  DATA 10,13,10,13
0073  TEXT '(2)  ABSTRACT GRAPHS'
0074  DATA 10,13,10,13
0075  TEXT '(3)  LISTS@'
0076 MN8 DATA HMN
0077 HMN TEXT '   WHICH YEAR?'
0078  DATA 10,13,10,13
0079  TEXT '(1)  1976'
0080  DATA 10,13
0081  TEXT '(2)  1977'
0082  DATA 10,13
0083  TEXT '(3)  1978'
0084  DATA 10,13
0085  TEXT '(4)  1979'
0086  DATA 10,13
0087  TEXT '(5)  1980@'
0088 MN9 DATA IMN
0089 IMN TEXT '(1)  HISTORIES'
0090  DATA 10,13,10,13
0091  TEXT '(2)  BORDER DETAILS'
0092  DATA 10,13,10,13
0093  TEXT '(3)  RURITANIA'
0094  DATA 10,13,10,13
0095  TEXT '(4)  OLYMPIA'
0096  DATA 10,13,10,13
0097  TEXT '(5)  TRANSYLVANIA@'
0098 MN10 DATA JMN
0099 JMN TEXT '(1)  NAMES OF SPIES THERE'
0100  DATA 10,13,10,13
0101  TEXT '(2)  TRANSACTIONS'
0102  DATA 10,13,10,13
0103  TEXT '(3)  POSSIBLE MESSAGES WITHIN,TO,OR FROM@'
0104  END
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96a

~~97a~~ 96b.